UNITED STATES SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM	10-K
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×	ANICAL REPORT TORSUANT TO SEC	For the fiscal year ended December 31, 2020					
_	TRANSITION REPORT BURGUANT TO	OR	CT OF 1024				
	TRANSITION REPORT PURSUANT TO	SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE AG For the transition period from					
		Commission file number: 001-36481	to				
ASPEN AEROGELS, INC. (Exact name of registrant as specified in its charter)							
	Delawar (State or other juri incorporation or o	sdiction of	(I.R.S. E	59972 mployer ation No.)			
	30 Forbes Road, 1 Northborough, Ma (Address of principal e	ssachusetts		532 Code)			
	(Address of principal e	Registrant's telephone number, including area code (50)	` •	couc _j			
		Securities registered pursuant to Section 12(b) of the Ex					
	Title of each class Common Stock, par value \$0.00001 per sh	Trading Symbol	Na Na	me of exchange on which registered New York Stock Exchange	<u> </u>		
	Common Stock, par value 30.00001 per si	ASPN		New York Stock Exchange			
		Securities registered pursuant to Section 12(g) of the Exchange	Act: None				
Indicat	e by check mark if the registrant is a well-know	n seasoned issuer, as defined in Rule 405 of the Securities Act. Yes	s □ No ⊠				
Indicat	e by check mark if the registrant is not required	to file reports pursuant to Section 13 or Section 15(d) of the Exchange	ge Act. Yes □ No ⊠				
	2	filed all reports required to be filed by Section 13 or 15(d) of the Secu ach reports), and (2) has been subject to such filing requirements for the	•		or such		
		mitted electronically every Interactive Data File required to be submit			oter)		
_		eriod that the registrant was required to submit such files). Yes 🗵					
Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "scalerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.							
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	nerging growth company, indicate by check maded pursuant to Section 13(a) of the Exchange A	ark if the registrant has elected not to use the extended transition perioct. \square	d for complying with any ne	w or revised financial accounting star	ndards		
Indicat	e by check mark whether the registrant has file	d a report on and attestation to its management's assessment of the eff by the registered public accounting firm that prepared or issued its at		trol over financial reporting under Se	ction		
Indicat	e by check mark whether the registrant is a she	Il company (as defined in Rule 12b-2 of the Exchange Act). Yes	□ No ⊠				
	ted by reference to the price at which the comm	on stock held by non-affiliates of the registrant (without admitting that non stock was last sold as of the last business day of the registrant's m					
	March 9, 2021, the registrant had 28,301,338 sh	ares of common stock outstanding.					
DOCUMENTS INCORPORATED BY REFERENCE							
	s of the registrant's definitive Proxy Statement e extent stated herein.	for its Annual Meeting of Stockholders to be held on June 1, 2021 are	e incorporated by reference i	nto Part III of this Annual Report on l	Form 10-		

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PART I

Item 1. BUSINESS

Aspen Aerogels, Inc. is an aerogel technology company that designs, develops and manufactures innovative, high-performance aerogel insulation used primarily in the energy infrastructure and building materials markets. The Company has also developed a high-potential line of aerogel thermal barriers that enable solutions to thermal runaway challenges in lithium-ion batteries used in the electric vehicle market. In addition, the Company conducts research and development related to aerogel technology supported by funding from several agencies of the U.S. government and other institutions. The Company has decided to cease efforts to secure additional funded research contracts and to wind down existing contract research activities. When used in this report, the terms "we," "us," "our" and "the Company" refer to Aspen Aerogels, Inc. and its subsidiaries.

We design, develop and manufacture innovative, high-performance aerogel insulation used primarily in the energy infrastructure and building materials markets. We believe our aerogel blankets deliver the best thermal performance of any widely used insulation product available on the market today and provide a combination of performance attributes unmatched by traditional insulation materials. Our end-use customers select our products where thermal performance is critical and to save money, improve resource efficiency, enhance sustainability, preserve operating assets and protect workers.

Our technologically advanced insulation products are targeted at the estimated \$3.1 billion annual global market for energy infrastructure insulation materials. Our aerogel insulation has undergone rigorous technical validation and is used by many of the world's largest oil producers and the owners and operators of refineries, petrochemical plants, liquefied natural gas facilities and power generating and distribution assets, such as ExxonMobil, Reliance Industries, PTT LNG, and Royal Dutch Shell. Our products replace traditional insulation in existing facilities during regular maintenance, upgrades and capacity expansions. In addition, our aerogel products are increasingly being specified for use in new-build energy infrastructure facilities.

We introduced our two key aerogel insulation product lines for the energy infrastructure market, Pyrogel and Cryogel, in 2008. Pyrogel and Cryogel have undergone rigorous technical validation by industry leading end-users and achieved significant market adoption. Our product revenue has grown from \$17.2 million in 2008 to \$99.8 million in 2020, representing a twelve-year compound annual growth rate of 16%. During this period, we have sold nearly \$1.1 billion of our products globally, representing an installed base of more than 382 million square feet of insulation. We believe that our twelve-year track record of success positions us for future growth and continued gain in market share in the energy infrastructure market.

We have grown our business by forming technical and commercial relationships with industry leaders, which has allowed us to optimize our products to meet the particular demands of targeted market sectors. We have benefited from our technical and commercial relationships with ExxonMobil in the oil refinery and petrochemical sector, with TechnipFMC in the offshore oil sector and with BASF in the building materials market. We will continue our strategy of working with innovative companies to target and penetrate additional opportunities in the energy infrastructure and building materials markets.

We are also actively developing a number of promising aerogel products and technologies for the electric vehicle market. We have developed and are commercializing our proprietary line of PyroThin thermal barriers for use in lithium-ion batteries in electric vehicles. Our PyroThin product is an ultra-thin, lightweight and flexible thermal barrier engineered to meet the safety and performance demands of electric vehicle manufacturers. These thermal barriers are designed to impede the propagation of thermal runaway both at the battery cell and battery pack levels across multiple lithium-ion battery system architectures. Our technology offers a unique combination of performance attributes that enable electric vehicle manufacturers to achieve critical safety goals without sacrificing driving range.

In addition, we are seeking to leverage our patented carbon aerogel technology to develop industry-leading battery materials for lithium-ion battery systems in electric vehicles. These silicon-rich, carbon aerogel materials have the potential for use as a drop-in replacement for graphite in the anode of lithium-ion batteries to enable an increase in the drive range of electric vehicles.

The commercial potential for our PyroThin products and carbon aerogel materials in the electric vehicle market is significant and is likely to require us to hire additional personnel, incur additional operating expenses and incur capital expenditures to expand our manufacturing capacity, build an automated fabrication operation, and meet automotive quality system requirements, among other items.

We also derive product revenue from the building materials and other end markets. Customers in these markets use our products for applications as diverse as wall systems, military and commercial aircraft, trains, buses, appliances, apparel, footwear and outdoor gear. As we continue to enhance our aerogel technology platform, we believe we will have additional opportunities to address high value applications in the global insulation market, the electric vehicle market and in a number of new, high-value markets.

Our patented aerogel products and manufacturing technologies are significant assets. Silica aerogels are complex structures in which 97% of the volume consists of air trapped between intertwined clusters of amorphous silica solids. These extremely low-density solids provide superior thermal and acoustic insulating properties. Although silica aerogels are usually fragile materials, we have developed innovative and proprietary manufacturing processes that enable us to produce industrially robust aerogel insulation cost-effectively and at commercial scale. Our electrically conductive carbon aerogel materials are reaching development maturity, expanding our market opportunities in energy storage, filtration, water purification, and gas sorption. These patented carbon aerogels are uniquely strong, providing the physical strength, charge and ion conductivity, and porosity required to host high concentrations of silicon in lithium-ion battery anodes. These silicon carbon aerogels have the potential to lower the costs and increase the energy density of electric vehicle battery systems.

Our insulation products help customers to improve the resource efficiency and sustainability of their operations. These products enable compact system design, reduce installation time and costs, promote freight and logistics cost savings, reduce system weight, minimize required storage space and enhance job site safety. Our insulation products reduce the incidence of corrosion under insulation, which is a significant maintenance cost and safety issue in energy infrastructure facilities. Many of our insulation products also offer strong fire protection, which is a critical performance requirement in our markets. We believe our array of product attributes provides strong competitive advantages over traditional insulation. Although competing insulation materials may have one or more comparable attributes, we believe that no single insulation material currently available offers all of the properties of our aerogel insulation products.

Our aerogel thermal barrier products enable our customers to enhance the safety and performance of their lithium-ion battery systems. These barriers are designed to impede the propagation of thermal runaway in lithium-ion battery systems both at the battery cell and battery pack level across multiple lithium-ion battery system architectures. Our ultra-thin, lightweight and flexible thermal barriers allow battery manufacturers to achieve critical safety goals without sacrificing energy density. We believe we offer the best available technology in the management of thermal runaway in the electric vehicle market.

Total revenue for the years ended December 31, 2020, 2019 and 2018 was \$100.3 million, \$139.4 million and \$104.4 million, respectively. For the years ended December 31, 2020, 2019 and 2018, based on shipment destination or research services location, our U.S. revenue was \$44.8 million, \$58.3 million and \$41.7 million, respectively, and our international revenue was \$55.5 million, \$81.0 million and \$62.6 million, respectively.

With regard to the COVID-19 pandemic, we have implemented and are following safe practices recommended by public health authorities and other government entities. We will continue to focus on the safety and health of our employees, customers and vendors. We have implemented various precautionary measures, including remote work arrangements, restricted business travel and procedures for social distancing, face coverings and safe hygiene. We continue to monitor public health guidance as it evolves and plan to adapt our practices as appropriate. Refer to the section below entitled "Item 1A. Risk Factors" for more information concerning risks to our business associated with COVID-19.

We manufacture our products using our proprietary technology at our facility in East Providence, Rhode Island. We have operated the East Providence facility since 2008 and have increased our annual capacity in phases through December 31, 2020 to 55 million square feet of aerogel blankets. We are currently engaged in an initiative, which we refer to as EP20, designed to increase the capacity of the East Providence facility to 60 million square feet of aerogel blankets by the end of 2021. In addition, we anticipate that we will need to construct a state-of-the-art thermal barrier fabrication operation, hire dedicated thermal barrier fabrication employees, and increase our aerogel blanket manufacturing capacity to keep pace with the significant potential demand for our PyroThin thermal barriers from the electric vehicle market. Accordingly, we are in the early stages of planning a significant expansion of our aerogel capacity prior to the end of 2023. The expected elements of the completed expansion plan will include the size of the required capacity expansion, the selection of an optimal manufacturing site for the expansion, the appropriate financing structure to fund the project fully and a detailed timeline for the construction and operation of the facility.

Financial information about our product and research services revenues, net loss per share and our total assets are provided in our consolidated financial statements included elsewhere in this Annual Report on Form 10-K.

Our Markets and Competition

Our principal market is the energy infrastructure insulation market. This market is global, well-established and includes large and well-capitalized end-users. This market includes companies operating refinery, petrochemical, oil production, and LNG production and storage facilities. The market also includes firms operating gas, coal, nuclear, hydro and solar thermal power generating plants and district energy systems. Insulation systems in the energy infrastructure market are designed to maintain hot and cold process equipment, piping and storage tanks at optimal temperatures, to protect plant and equipment from the elements and from the risk of fire, and to protect workers. The market is served by a well-organized, well-established, worldwide network of distributors, contractors and engineers.

Demand for insulation in the energy infrastructure market is composed of demand associated with new-build construction of facilities, capital expansions and related capital projects, as well as with routine, non-discretionary maintenance programs within existing facilities. Capital expansions and related capital projects in the energy infrastructure market are driven primarily by overall economic growth and projected growth in energy demand. Maintenance programs are essential to optimal operation of process equipment, to protect workers and to minimize the risk of a catastrophic loss. Accordingly, we believe that demand for insulation for maintenance purposes in comparison to capital projects is less affected by volatility associated with economic cycles, energy prices and other macroeconomic factors.

The major end-use markets that drive demand for our products include oil refining, petrochemical, natural gas and LNG production and storage, onshore oil production, offshore oil production and power generation. Global energy demand is expected to increase in the long-term and, in order to serve this growing demand, we believe our end-use customers will continue to invest in major energy infrastructure projects.

We have also developed and are commercializing a proprietary line of aerogel thermal barriers for use in lithium-ion batteries. The market for our thermal barrier products encompasses batteries used in both mobile platforms, including automobiles, trucks, buses and light aircraft, and fixed platforms, including grid storage and other commercial applications. The global lithium-ion battery market is estimated to be more than \$40.0 billion in 2020 and is both growing and evolving rapidly. Our thermal barrier products allow our customers to enhance the safety of their high-energy density lithium-ion battery platforms. We believe that as the e-mobility and energy storage markets require increasingly powerful lithium-ion battery systems, the demand for our aerogel thermal barriers will grow rapidly as the market players seek to reduce the associated risk of thermal runaway.

On September 17, 2020, we entered into a contract with a major U.S. automotive original equipment manufacturer to supply fabricated, multi-part thermal barriers for use in the battery system of its next-generation electric vehicles. Pursuant to the contract, we are obligated to supply the barriers at fixed annual prices and at volumes to be specified by the customer up to a daily maximum quantity through the term of the agreement, which expires on September 1, 2026. While the customer has agreed to purchase all of its requirement for barriers at locations to be designated from time to time from us, it has no obligation to purchase any minimum quantity of barriers under the contract. In addition, the customer may terminate the contract any time and for any or no reason. All other terms of the contract are generally consistent with the customer's standard purchase terms, including customary quality and warranty provisions.

We also sell our products for use in the building materials and other end markets, including for the fabrication of insulation parts by original equipment manufacturers, or OEMs. These OEMs develop products incorporating our aerogel blankets for applications in a diverse set of markets including military aircraft, trains, buses, appliances, apparel, footwear and outdoor gear. While these are not presently our core markets, we anticipate that we will allocate a growing portion of our manufacturing capacity to serve these markets in the long term. We believe the key performance criteria for insulation in these markets and applications include thermal performance, compact design, durability and fire resistance.

We operate in a highly competitive environment. In the energy infrastructure and building materials markets, we compete with traditional insulation materials based on product performance, price, availability and proximity to the customer. Customers may choose among a variety of insulation materials that offer a range of characteristics including thermal performance, durability, vapor permeability, moisture resistance, ease of installation and upfront and lifecycle costs. Within each type of insulation material, there is also competition between the manufacturers of that material. Most types of traditional insulation materials are produced by a number of different manufacturers and once customers have chosen the type of insulation material that they intend to use, they will choose a manufacturer of that material based primarily on each manufacturer's price and delivery schedule. Insulation manufacturers include a range of large, high-volume, multinational manufacturers offering branded products and strong technical support services to small, low-volume, local manufacturers offering low prices and limited customer support.

We believe the primary competitive factors in these markets are:

- product performance (along multiple criteria), quality and fitness for purpose;
- product price, installed cost and lifecycle cost;
- product availability; and
- proximity to customer and logistics.

Our products are priced at a premium to traditional insulation materials. While our competitors offer many traditional insulation products that are priced below our products on a per-unit basis, we believe our products have superior performance attributes and may have the lowest cost on a fully-installed basis or offer significant life-cycle cost savings.

Competition in the thermal barrier market is evolving. We believe our patented aerogel thermal barrier technology offers a unique combination of attributes to mitigate thermal runaway in lithium-ion battery systems. These attributes include industry-leading thermal performance, limited combustibility, tunable compressibility and scalable density. We expect to face increasing competition within the thermal barrier market over the next several years as new entrants seek to develop and market their own technologies and solutions.

We compete in the aerogel materials market with Cabot Corporation, Armacell International S.A., Guangdong Alison Hi-Tech Co., Ltd. and Nano Tech Co., Ltd. and a growing number of other competitors that manufacture, sell or resell aerogel insulation products. We expect to face increasing competition in the aerogel insulation market over the next several years as existing competitors and new entrants seek to develop and market their own aerogel products. In addition to other aerogel insulation products, we also encounter competition from innovatively packaged traditional insulation materials that compete with our products based on one or more performance factors.

Within each of our target markets, we encounter one or more of these organizations or their resellers and a significant number of other aggressive national, regional and local suppliers of traditional insulation products. Our competitors are seeking to enhance traditional insulation materials and to develop and introduce new and emerging insulation technologies. Competing technologies that outperform our insulation products in one or more performance attributes could be developed and successfully introduced. See "Risk Factors—The energy infrastructure insulation market is highly competitive; if we are unable to compete successfully, we may not be able to increase or maintain our market share and revenues."

Our market share in 2020 was approximately 4% of the estimated \$3.1 billion annual global market for energy infrastructure insulation materials. Our market share in 2020 in the building materials, thermal barrier and other markets was not significant. Many of our competitors have greater market presence, larger market share, longer operating histories, stronger name recognition, larger customer bases and significantly greater financial, technical, sales and marketing, manufacturing and other resources than we have and may be better able to withstand volatility within the industry and throughout the economy as a whole while retaining greater operating and financial flexibility. If our competitors lower their prices, or develop new products with better performance, or if we are unable to compete effectively, our growth opportunities, share of the market, margins and profitability may decline.

Our Competitive Strengths

Because insulation is used in a wide variety of demanding applications, insulation materials must satisfy a wide range of performance criteria on a cost-effective basis. We believe that our aerogel technology has allowed us to create superior insulation products for our energy, building materials and thermal barrier markets that will allow us to continue to grow our share of the global insulation and thermal barrier market. We believe that the potential for significant technological innovation in traditional materials is limited and that new high-performance materials will be required to meet evolving market requirements for energy efficient insulation and thermal barrier systems. Our line of high-performance aerogel products is positioned to meet these requirements. Our solutions are driven by our innovative and proprietary technology that produces aerogels in a flexible and industrially robust blanket form and is supported by over 20 years of research and development dedicated to new aerogel compositions, form factors and manufacturing technologies. We believe our aerogel blankets deliver a superior combination of performance attributes that enable energy infrastructure and building materials end-users to save money, improve resource efficiency, preserve operating assets and protect workers across a wide range of applications in our target markets. We believe our patented aerogel thermal barriers offer an industry-leading combination of attributes to mitigate thermal runaway in lithium-ion battery systems.

We believe the following combination of capabilities distinguishes us from our competitors and positions us to continue to gain market share in the energy infrastructure, building materials and electric vehicle markets:

- Disruptive Products with a Compelling Value Proposition. Our aerogel insulation provides two to five times the thermal performance of widely used traditional insulation in a thin, easy-to-use and durable blanket form. We believe our array of product attributes provides strong competitive advantages over traditional insulation and will enable us to gain a larger share of the energy infrastructure insulation market. In addition, our aerogel thermal barriers offer a combination of attributes that provide industry-leading protection against thermal runaway in lithium-ion batteries. We believe our thermal barriers are the market leading technological solution to combat thermal runaway and we will gain share within the market for lithium-ion batteries used in the e-mobility and grid storage markets. Although competing materials may have one or more comparable attributes, we believe that no single insulation or thermal barrier materials currently available offer all of the properties of our aerogel products.
- Important End Markets. Our aerogel insulation products are primarily used in large-scale energy infrastructure facilities. Our aerogel thermal barrier products are gaining share in the rapidly growing, high value electric vehicle market. Given the projected high growth in the e-mobility markets and continued growth in global energy consumption in the long-term, and the construction of new facilities to satisfy this demand, we believe that we serve well-capitalized and rapidly growing global end markets. In order to capture the opportunities in our end markets, we have a network of sales professionals and qualified distributors in more than 50 countries around the world.

- Strong Installed Base with Industry-leading Energy Customers. We have an installed base of more than 382 million square feet of insulation, representing nearly \$1.1 billion in cumulative product sales since 2008. Through our relationships with industry leading energy infrastructure customers, our products have undergone rigorous testing and technical validation and are now in use at most of the world's largest oil producers, refiners and petrochemical companies. These relationships have shortened the sales cycle with other customers and have helped to facilitate our market penetration. We also have strong relationships with a global network of energy-focused distributors, contractors and engineering firms that understand the significant advantages our products provide to end-users.
- Initial Adoption by Leading Electric Vehicle Customer. In September 2020, we entered into a contract with a major U.S. automotive original equipment manufacturer to supply fabricated, multi-part thermal barriers for use in the battery system of its next-generation electric vehicles. This relationship has helped to validate our thermal barrier technology with other companies providing products and solutions to the electric vehicle, lithium-ion battery and grid storage markets. We have submitted proposals in response to RFQs for both an electric truck and a grid storage battery system and engaged in discussions and development activities with more than ten other prospective customers in the broader e-mobility and energy storage markets.
- **Proven, Scalable Business Model.** Our proprietary manufacturing technology is proven and has been successfully scaled up to meet increasing demand. We have operated the East Providence facility since 2008 and have significantly increased manufacturing capacity and productivity during the period. We successfully commenced operation of our second production line at this facility in March 2011 and doubled our annual capacity to 40 million square feet of aerogel blankets. We commenced operations of a third line in the East Providence facility during 2015 and increased our annual capacity by 25% to 50 million square feet of aerogel blankets. During 2018, we initiated a series of projects, which we refer to as EP20, designed to increase the capacity in our East Providence facility to 60 million square feet. As of December 31, 2020, we had increased the nameplate capacity in our East Providence facility to 55 million square feet of aerogel blankets and currently expect to achieve our EP20 goals by the end of 2021.
- Protected Technology Platform and Proprietary Manufacturing Capability. Our aerogel technology platform is the result of more than 20 years of research and development dedicated to new aerogel compositions, form factors and manufacturing technologies. Our intellectual property portfolio is supported by 145 issued patents, with an additional 113 pending and one allowed, in U.S. and foreign jurisdictions in areas related to product design, chemistry, process technology and market applications. In addition, we have significant knowledge and trade secrets related to product formulations and manufacturing techniques. We believe our portfolio of patents, trade secrets and knowledge present a barrier to potential new entrants in the commercialization of aerogel blanket insulation.
- Experienced Management Team with a Demonstrated Track Record. Our executive officers have an average of more than 20 years each of experience in global industrial companies, specialty chemical companies or related material science research. This management team is responsible for the continued development of our aerogel technology platform, the commercial acceptance of our products, and the creation of a global distribution and marketing platform. As of December 31, 2020, we employed 290 people including material scientists, engineers, manufacturing line operators, sales personnel, administrative staff, and management. We believe our dedicated and experienced team is an important competitive asset.

Our Growth Strategy

Our strategy is to create economic value by leveraging our technological and market leadership in aerogels to be the premier provider of high-performance aerogel products serving the global electric vehicle and energy infrastructure markets. We also will pursue high-value opportunities for our aerogel insulation products within the building materials market and a diverse set of new markets. In addition, we will leverage our aerogel technology platform to develop innovative, aerogel-enhanced products for applications outside the global insulation market.

Key elements of our strategy include:

• Leverage Aerogel Technology Platform in the Electric Vehicle Market. We plan to build upon the initial commercial success of our industry-leading PyroThin thermal barriers within the battery systems of electric vehicles. We will hire experienced automotive business development personnel, construct a state-of-the-art thermal barrier fabrication operation, hire dedicated thermal barrier fabrication employees, and increase our aerogel blanket manufacturing capacity to keep pace with the significant potential demand for our PyroThin thermal barriers. In addition, we will seek to leverage the unique properties of our proprietary and patented carbon aerogels to improve the performance and cost of lithium-ion batteries. We will continue our efforts with our evaluation partners, SKC Co., Ltd. and Evonik Industries AG, to explore the potential use of Aspen's silicon-rich carbon aerogel materials in the anode and cathode of lithium-ion batteries and in solid-state batteries. We will continue to seek to engage with additional leading battery material and electric vehicle manufacturers to realize the full potential of our silica aerogels, our carbon aerogels and our broader aerogel technology platform within the electric vehicle market.

- Capitalize on Innovation to Develop New Markets. Our team of materials scientists and engineers focus on advancing our aerogel technology platform and developing next generation aerogel compositions, form factors and manufacturing processes. We believe that we are well-positioned to leverage over 20 years of research and development to develop and commercialize disruptive aerogel products for a wide array of new markets beyond the energy infrastructure, building materials and electric vehicle markets. We will seek to exploit the unique characteristics of aerogels, including low thermal conductivity, high surface area, high electrical conductivity, and tunable porosity, to develop aerogel-enhanced products and next generation technology addressing complex and unmet market needs. We will continue to seek potential partnerships with industry leaders that include a mix of commercial, technical and financial elements to realize the full potential offered by our proprietary aerogel technology platform in targeted markets.
- Strategically Increase Capacity to Meet Demand. Demand for our aerogel products has grown significantly since our inception. From 2008 through 2020, our product revenue has grown at a compound annual growth rate of 16% to \$99.8 million. To meet growth in demand for our products, we added a third production line in our East Providence facility in 2015 that increased our annual capacity to 50 million square feet of aerogel blankets. We are engaged in a series of projects, which we refer to as EP20, designed to increase the capacity of our East Providence facility by an additional 10 million square feet of aerogel blankets by the end of 2021. As of December 31, 2020, we have increased the capacity of our East Providence facility to 55 million square feet of aerogel blankets and expect to achieve the targeted 60 million square feet of aerogel blankets by the end of 2021. In addition, in order to support the projected growth in our electric vehicle and energy infrastructure markets, we are in the early stages of planning a significant expansion of our aerogel capacity prior to the end of 2023. The expected elements of the completed expansion plan will include the size of the required capacity expansion, the selection of an optimal manufacturing site for the expansion, the appropriate financing structure to fund the project fully and a detailed timeline for the construction and operation of the facility.
- Broaden Energy Market Diversity and Grow Market Share. We plan to add resources to continue to grow our share of the energy infrastructure insulation market, both through increased sales to our existing customers and through sales to new customers. We plan to continue to expand and enhance our global sales and distribution network and seek to promote greater enterprise-wide adoption of our products by existing end-use customers. To date, the majority of our revenue has been generated from applications in refineries and petrochemical facilities. We will continue to pursue and expect greater adoption of our products for applications in the LNG and power markets. In addition, our product revenue will continue to be generated, in large part, by demand for insulation associated with scheduled plant shutdowns, or turnarounds, and other maintenance-related projects. With broad adoption of our products and our growing installed base, we expect that our products will be specified at increasing rates during the design phase in a growing number of new-build and capital expansion projects. We also expect that growth in global energy demand over time will result in increased new-build and large capacity expansion projects; thereby driving additional demand for our aerogel products.
- Leverage Strategic Relationships in the Building Materials Market. We are pursuing market opportunities across multiple regions to address the increasingly stringent regulatory environment governing the thermal performance and fire safety of buildings. We have entered into a multi-faceted strategic partnership with BASF to develop and commercialize products optimized for the building materials market. The strategic partnership offers a near-term commercial opportunity through the sale of our Spaceloft A2 product line and long-term commercial potential through our joint development efforts focused on innovative products and technologies that address emerging opportunities. We believe our strategic partnership with BASF has the potential to facilitate our penetration of the building materials market by combining the strength of our aerogel technology platform with BASF's broad technical, commercial and distribution capabilities.
- Enhance Our Profit Margins, Operational Cash Flow and Return on Invested Capital. We will seek to improve the efficiency of our manufacturing process, to optimize the formulation of our products and to manage our supply chain to reduce costs. We believe additional opportunities to realize production efficiencies and to reduce per unit overhead costs will arise with growth in the scale of our manufacturing operations. We believe our current expansion plans and available manufacturing technology advancements will enhance profit potential, increase operating cash flow capability, and offer attractive returns on incremental invested capital. In addition, we will focus our development efforts on new products and next generation technology with application in new, high value market segments.

Our Aerogel Products

Silica aerogels are highly porous structures in which 97% of the volume consists of air trapped between intertwined clusters of amorphous silica solids. Silica aerogels are a very low-density solids and are extremely fragile materials. However, our proprietary manufacturing process produces silica aerogels in a flexible, resilient, durable and easy-to-use blanket form.

The core raw material in the production of our aerogel insulation products is silica precursors. Our manufacturing process initially creates a semi-solid alcogel in which the silica structure is filled with ethanol. We produce aerogel by means of a supercritical extraction process that removes ethanol from the gel and replaces it with air. Our process allows the ethanol to be extracted without causing the solid matrix in the gel to collapse from capillary forces.

Our material costs were 44%, 48% and 47% of product revenue for the years ended December 31, 2020, 2019 and 2018, respectively. We seek to lower our manufacturing costs, while maintaining appropriate performance characteristics, and to improve the per square foot costs of our silica aerogel blankets by optimizing our formulations to reduce material costs, by enhancing manufacturing process controls to improve yields, by realizing price reductions from existing vendors, by qualifying new vendors and by reducing shipping costs. Our objective is both to reduce costs to enhance our competitive position and to ensure we deliver high quality products to our customers.

The materials used in the production of our silica aerogel products consist primarily of several silica precursors, fiber batting, and other additives. The markets for these materials are generally competitive and multiple sources of supply exist for all of our raw materials. However, from time-to-time, we have experienced a significant increase in the price of certain silica precursors due to supply imbalances in the silanes market. We are actively working to reformulate our products to reduce our reliance on the materials that are susceptible to significant price fluctuations. We are also working to expand the geographic diversity of our supply base to reduce the risk of demand and supply imbalances in any one country or region.

We purchase silica precursors from several suppliers in the United States, Europe and Asia, including China. Based on the current level of demand for our products, we believe that an adequate long-term supply of silica precursors is available. However, if demand for our products increases rapidly, we will need to work with suppliers to ensure that an adequate long-term supply of silica precursors will be available at competitive prices. Suppliers of silica precursors include industrial companies that produce the materials directly or that produce them as a byproduct of other industrial processes. We are working with a number of these suppliers to plan for our potential future needs and to develop our processes to reduce the long-term cost impact of these materials. See "Risk Factors — Shortages of the raw materials used in the production of our products, increases in the cost of such materials or disruptions in our supply chain could adversely impact our financial condition and results of operations."

Our aerogel blankets are reinforced with fiber batting. We manufacture and sell our blankets in 60-inch-wide, three-foot diameter rolls with a standard range of thickness of 2 millimeters to 10 millimeters. Our base products are all flexible, hydrophobic, vapor permeable, compression resistant and able to be cut and fabricated using conventional tools. We have specifically developed our line of aerogel blankets to meet the requirements of a broad set of applications within our target markets. The composition and attributes of our standard aerogel blankets are described below:

Electric Vehicle Market

• **PyroThin.** PyroThin thermal barriers are our new generation of ultra-thin flexible aerogel products engineered to satisfy the needs of the electric vehicle and energy grid industries to address thermal runaway issues in lithium-ion batteries. PyroThin thermal barriers can be tailored to provide passive fire protection at the cell, module or pack level within lithium-ion battery systems. PyroThin thermal barriers are offered to enable electric vehicle manufacturers to design lithium-ion batteries which improve both electric vehicle safety and driving range.

Energy Infrastructure Markets

- **Pyrogel XTE.** Pyrogel XTE, our best-selling product, is reinforced with a glass-fiber batting and has an upper use temperature of 650° C. Pyrogel XTE was initially designed for use in refineries and petrochemical facilities, but has proven to have wide applicability throughout the energy infrastructure market. Pyrogel XTE is optimized for high temperature applications between 100° C and 400° C. Pyrogel XTE's hydrophobicity and vapor permeability reduce the risk of corrosion under insulation in energy infrastructure operating systems when compared to traditional insulation.
- **Pyrogel HPS.** Pyrogel HPS is optimized for applications within the power generation market with operating temperatures greater than 400° C. With an upper use temperature of 650° C, high durability and extremely low thermal conductivity, Pyrogel HPS is ideal for installation in high performance turbine systems and in demanding thermal environments in power plants and systems. Pyrogel HPS also provides strong value at high temperatures and in demanding thermal applications in refining and chemical processing systems.
- **Pyrogel XTF.** Pyrogel XTF provides thermal performance similar to Pyrogel XTE, but is reinforced with a glass- and silica-fiber batting. Pyrogel XTF is specially formulated to provide strong protection against fire.
- Cryogel Z. Cryogel Z is designed for sub-ambient and cryogenic applications in the energy infrastructure market. Cryogel Z is reinforced with a glass-and polyester-fiber batting and is produced with an integral vapor barrier. Cryogel Z is also

specially formulated to minimize the incidence of stress corrosion cracking in stainless steel systems. Cryogel Z's combination of properties allow for simplified system designs and reduced installation costs in cold applications throughout the energy infrastructure market when compared to traditional insulation

• Spaceloft Subsea. Spaceloft Subsea is reinforced with glass- and polyester-fiber batting and is designed for use in pipe-in-pipe applications in offshore oil production. Spaceloft Subsea is typically fabricated and pre-packaged to permit faster installation. Spaceloft Subsea allows for small profile carrier pipelines and associated reductions in capital costs.

Other Markets

- Spaceloft Grey. Spaceloft Grey is reinforced with a glass-and polyester-fiber batting and is designed for use in the building materials market. Spaceloft Grey is either utilized in roll form by contractors in the field or fabricated by OEMs into strips, panels and systems that meet industry standards. Spaceloft Grey is designed for use in solid wall buildings and where space is at a premium.
- Spaceloft A2. Spaceloft A2 is reinforced with a glass-fiber batting and specifically designed to meet Euroclass A2 fire standards in the building materials market. Spaceloft A2 is marketed and sold exclusively by our partner BASF SE under the SLENTEX® brand. Spaceloft A2 is designed to provide industry-leading thermal performance in applications where building regulations require the use of non-combustible products.
- Cryogel X201. Cryogel X201 is similar in composition to Cryogel Z, but is produced without the integral vapor barrier. Cryogel X201 is designed for use in cold system designs where space is at a premium. Cryogel X201 is targeted to OEMs that design, produce and sell refrigerated appliances, cold storage equipment and aerospace systems.

R-Values by Material

Insulation is a material or combination of materials that slows the transfer of heat from one side of the material to the other. The composition of our aerogel products minimizes the three mechanisms of thermal transport:

- *Conduction.* Heat conduction through a material is correlated to the material's density. Aerogels are very low-density solids. As a result, thermal conductivity through the aerogel material itself is extremely low.
- Convection. Heat convection in gases is through movement of gas molecules. Due to the restricted movement of gases in the nanoporous aerogel structure, thermal convection is eliminated inside the aerogels.
- *Radiation.* Radiation requires no medium to transfer the heat. Thermal radiation is partially absorbed by aerogels. Our aerogel products also contain infrared absorbing additives to significantly reduce radiant heat transfer.

We believe our aerogel products offer the lowest levels of thermal conductivity, or best insulating performance, of any widely used insulation or thermal barrier available on the market today.

The lower a material's thermal conductivity, the more slowly heat is transferred through the material. R-values are a commonly used measure of an insulating material's resistance to heat transfer. R-value is calculated as the thickness of an insulation material divided by the thermal conductivity of the insulation material. Materials with higher R-values have lower thermal conductivity and are better insulators. Traditional and specialty insulation materials provide a range of R-values. Aerogels have the highest R-value per unit of thickness in comparison to traditional insulation materials.

Qualification for Use

Our products have undergone rigorous testing and are now qualified for global usage in both routine maintenance and in capital projects at many of the world's largest oil producers, refiners and petrochemical companies and prospectively with the next-generation lithium-ion battery systems of two of the largest electric vehicle manufacturers. These end-users of our products have well defined practices, codes, specifications and standards for materials and systems installed in their vehicles or used in their facilities. These specifications include insulation system design standards, material qualification and selection processes, insulation application practices and quality control requirements. As part of the material qualification process established by these companies, a new insulation or thermal barrier product must meet general industry standards, such as consensus standards developed by ASTM International, and, in many cases, company-specific internal standards to be considered and approved for use or designed into vehicle platforms. In addition, most of these companies require one or more field trials of tests to evaluate fitness for use in specific applications. These companies either run these qualification processes and field trials internally or through third parties engaged by them, and they generally do not publicly disclose the results of their testing. While the specific processes and timelines vary from company to company, in general, upon successful completion of the qualification process for an insulation or thermal barrier product,

an end-user will typically deem the product to be qualified for use in its facilities on a local, regional or global basis for one or more applications or vehicles. Because our end-use customers are typically businesses with very large operations in multiple sites, our insulation or thermal barrier sales likely represent only a small portion of the total product used by any one of these companies. Accordingly, once our products are qualified or designed into a platform at a specified company, we continue to seek to expand use of our products by the end-use customer in additional applications, platforms, locations or vehicles.

Our Sales Channel

We market and sell our products primarily through our global sales force. Our sales personnel are based in North America, Europe and Asia and travel extensively to market and sell our products to new and existing customers. The efforts of our sales force are supported by a small number of sales consultants with extensive knowledge of a particular market or region. Our sales force establishes and maintains customer and partner relationships, delivers highly technical information and provides first class customer service. We plan to expand our sales force and business development resources globally to support anticipated growth in customers and demand for our products.

Our sales force calls on and maintains relationships with participants at all levels of the energy infrastructure industry supply chain. We have established a network of insulation distributors to ensure rapid delivery of our products in critical regions. Our sales personnel work to educate insulation contractors about the technical and operating cost advantages of aerogel blankets. Our sales force also works directly with end-users and engineering firms to promote qualification, specification and wider acceptance of our products in existing and new applications. In the energy infrastructure market, we rely heavily on the existing and well-established channel of distributors and contractors to deliver products to our customers. In addition, our sales and business development personnel work directly with OEMs and strategic partners, including within the electric vehicle industry, to create new product designs and solutions to expand our market reach.

The sales cycle for a new insulation material or thermal barrier is typically lengthy. Our sales cycle from initial customer contact to widespread use can take from one to three years, although we typically realize increasing revenue at each stage in the cycle. We believe our relationships with technically sophisticated customers and strategic partners serve to validate our technology, products and value proposition within a target market. These relationships have proven to accelerate the sales cycle with other customers within specific markets and to facilitate growth in market share. We have focused our marketing efforts on developing technical support materials, installation guides, case studies and general awareness of the superior performance of our aerogel blankets and thermal barriers. We rely principally on our website, social media, printed technical materials, participation in industry conferences and tradeshows and presentation of technical papers to communicate our message to existing and potential customers. We also receive strong word-of-mouth support from the growing network of distributors, installation contractors, OEMs, strategic partners and end-users that understand the benefits of our products.

As of December 31, 2020, we had 46 sales and marketing professionals worldwide. Their efforts were supported by a team of ten sales consultants.

Our Customers and End-Users

Customers

Our primary customers in the energy infrastructure market are distributors, installation contractors and fabricators that stock, install and customize insulation products, components and systems for technically sophisticated end-users that require high-performance insulation.

- **Distributors:** We currently operate through a global network of 68 insulation distributors. In general, insulation distributors stock, sell and distribute aerogel materials to insulation contractors and end-users. The distribution of our product outside the United States is at times conducted under agreements that provide for exclusivity by geography linked to annual purchase volume minimums. These insulation distributors typically market, promote and advertise our aerogel materials across their market.
- Contractors: We currently sell directly to a number of insulation contractors under project specific contracts or general purchase orders. Insulation contractors generally perform insulation installation, inspection, maintenance and project management for end-users. In addition, some insulation contractors provide end-users with project engineering and design services.

- *Fabricators:* We currently sell directly to a small network of fabricators that design, customize and manufacture insulation components and systems for use in the energy infrastructure, industrial, building materials, transportation, appliance and apparel markets.
- **Direct Sales to End-Users:** In certain instances, we sell directly to end-use customers in the energy infrastructure insulation market. In these instances, our end-use customer directly manages and controls specification, logistic, installation, inspection, maintenance and fabrication activities of our aerogel products.

Our current customers in the evolving electric vehicle market include an original equipment manufacturer, a Tier one automotive supplier, and an Asian-based distributor of fabricated thermal barriers to the electric vehicle industry. We also anticipate that our customer base could expand to include manufacturers of lithium-ion batteries for the electric vehicle and grid storage markets.

Distribution International, Inc. and SPCC Joint Venture represented 21% and 15%, respectively, of our total revenue in 2020 and were our only customers representing 10% or more of our revenue for that period.

Our product revenue is generated by sales to customers around the world. In 2020, 44% of our product revenue was generated in the United States, 38% in Asia, 14% in Europe, 1% in Canada and 2% in Latin America based on shipment destination.

A substantial portion of our sales are to shipment destinations located outside the United States, including Thailand, Norway, Korea, Malaysia, The United Kingdom, Germany, Singapore, Australia, China, and Columbia. Total revenue generated from outside of the United States amounted to \$55.5 million or 55% of total revenue, \$81.0 million or 58% of total revenue and \$62.6 million or 60% of total revenue, in the years ended December 31, 2020, 2019 and 2018, respectively. In addition, we may continue to expand our operations outside the United States. As a result, we are subject to a number of risks. See "Risk Factors — A substantial portion of our revenue comes from sales in foreign countries and we may expand our operations outside of the United States, which subjects us to increased economic, foreign exchange, operational and political risks that could increase our costs and make it difficult for us to operate profitably."

End-Users

The end-users of our aerogel blankets and thermal barriers include some of the largest and most well capitalized companies in the world. Our products are installed in more than 50 countries worldwide.

Energy Infrastructure

- *Oil Refining:* We believe our products have been installed in more than 30% of the world's 640 refineries. In addition, we believe our aerogel blankets are used by 24 of the world's 25 largest refining companies including ExxonMobil, Shell and Chevron, among others. Over time, these companies have used our products in an increasing range of applications and throughout an increasing number of their facilities.
- Petrochemical: We believe our aerogel blankets are used by all of the world's 20 largest petrochemical companies including Reliance Industries, Formosa Petrochemical, and LyondellBasell Industries, among others.
- Natural Gas and LNG: Our products are in use at facilities operated by PTT LNG, ExxonMobil, and Dominion Energy, among others.
- Onshore: Our aerogel blankets are in use in several Canadian oil sands facilities owned and operated by Suncor Energy, ConocoPhillips and Husky Energy, among others.
- Offshore: Our products are currently used in subsea projects off the coast of Brazil, in the Gulf of Mexico, in the North Sea, off the coast of Malaysia and off the west coast of Africa. Our products are installed in offshore projects owned by Total, Marathon Oil, ConocoPhillips and Shell, among others.
- **Power Generation:** We are targeting operators of gas, coal, nuclear, hydro and solar power generating facilities. Our products are currently used at facilities owned and operated by NextEra Energy Resources, Southern Company and Duke Energy, among others.
- District Energy: Our products are used in medium- to high temperature steam distribution networks in universities and municipalities within the United States and Asia.

Electric Vehicle Market

Our thermal barrier products have been adopted for use in the electric vehicle battery systems of a major U.S. automotive manufacturer and by a leading Chinese electric vehicle manufacturer. We believe that our customer base could expand in the near term to include manufacturers of battery and battery systems for use in the electric vehicle and grid storage markets.

Our carbon aerogel program seeks to increase the performance of lithium-ion battery cells to enable electric vehicle manufacturers to extend the driving range and reduce the cost of electric vehicles, among other uses. We are targeting the manufacturers of battery components, batteries, grid battery systems, and electric vehicles as potential customers for our carbon aerogel materials.

Building Materials and Other Markets

Traditionally, we have relied on the efforts of a small network of partners, OEMs and fabrication houses to serve the building materials, transportation, apparel and appliance markets. These partners, OEMs and fabricators are manufacturers of components and systems for buildings, refrigerated and hot appliances, cold storage equipment, automobiles, aircraft, trains and electronic sectors and manufacturers of outdoor gear and apparel. In addition, we have collaborated with BASF to develop and commercialize innovative products optimized to meet the needs of the building materials market. The end-users of our products in these markets include a wide range of institutions, businesses, individuals, municipalities and government agencies.

Manufacturing

We manufacture our products using our proprietary technology at our facility located in East Providence, Rhode Island. We have operated the East Providence facility since 2008 and have significantly increased manufacturing capacity and productivity during the period. Our manufacturing process is proven, scalable and can meet increasing demand.

Our manufacturing group is led by a seasoned team with management experience at global industrial and specialty chemical companies. Our manufacturing workforce is skilled and we have experienced employee turnover consistent with our industry. We have well-defined operating processes and maintenance, environmental, health and safety programs to support our operations. We employ statistical processes and quality controls in our manufacturing systems. We routinely measure and monitor thermal conductivity, hydrophobicity and other key properties of the aerogel blankets produced in our manufacturing operations. We are ISO 9001:2015 certified.

We have increased our annual capacity in phases through December 31, 2020 to 55 million square feet of aerogel blankets. We are currently engaged in an initiative, which we refer to as EP20, designed to increase the capacity of the East Providence facility to 60 million square feet of aerogel blankets by the end of 2021. In addition, we anticipate that we will need to construct a state-of-the-art thermal barrier fabrication operation, hire dedicated thermal barrier fabrication employees, and increase our aerogel blanket manufacturing capacity to keep pace with the significant potential demand for our PyroThin thermal barriers. Accordingly, we are in the early stages of planning a significant expansion of our aerogel capacity prior to the end of 2023. The expected elements of the completed expansion plan will include the size of the required capacity expansion, the selection of an optimal manufacturing site for the expansion, the appropriate financing structure to fund the project fully and a detailed timeline for the construction and operation of the facility.

We directly control all stages in the manufacture of our aerogel blankets. Our direct ownership of manufacturing operations allows us to maintain control of proprietary process technologies and to control product quality. Our production of aerogel blankets utilizes a continuous process and consists of the following key steps:

- Sol Preparation. Mixing of silica precursors in ethanol, a catalyst and additives in set formulas to deliver the target properties of the resultant aerogel.
- Casting. Combination of the sol and fiber batting and initial formation of the gel structure.
- Aging. Bathing of the gel blankets in fluids to impart desired physical and thermal properties.
- Extraction. Supercritical extraction of the ethanol liquid from the gel blanket to produce a dried aerogel blanket.
- Heat Treatment. Drying to remove trace ethanol, salts and water from the aerogel blankets.

- *Finishing.* Coating to enhance quality and product handling.
- Fabrication. Cutting, lamination, and production of components and multi-layer systems for custom applications in the electric vehicle and subsea markets
- Quality Control. Utilizing statistical process and quality controls to measure thermal conductivity, hydrophobicity and other key properties of our aerogel products.

Our material costs were 44%, 48% and 47% of product revenue for the years ended December 31, 2020, 2019 and 2018, respectively.

The materials used in the production of our products consist primarily of a several silica precursors, fiber batting, and other additives. The markets for these materials are generally competitive and multiple sources of supply exist for all of our raw materials. However, during 2018, we experienced a significant increase in the price of certain silica precursors due to a supply imbalance in the silanes market. We are actively working to reformulate our products to reduce our reliance on materials that are susceptible to significant price fluctuations. We are also working to expand the geographic diversity of our supply base to reduce the risk of demand and supply imbalances in any one country or region.

We purchase silica precursors from several suppliers in the United States, Europe and Asia, including China. Based on the current level of demand for our products, we believe that an adequate long-term supply of silica precursors is available. However, if demand for our products increases rapidly, we will need to work with suppliers to ensure that the long-term supply of silica precursors will be available at competitive prices. Suppliers of silica precursors include industrial companies that produce the materials directly or that produce them as a byproduct of other industrial processes. We are working with a number of suppliers to plan for our potential future needs and to develop our processes to reduce the long-term cost impact of these materials. See "Risk Factors — Risks Related to Our Business and Strategy — Shortages of the raw materials used in the production of our products, increases in the cost of such materials or disruptions in our supply chain could adversely impact our financial condition and results of operations."

We seek to lower our manufacturing costs, while maintaining appropriate performance characteristics, and to improve the per square foot costs of our aerogel blankets by optimizing our formulations to reduce material costs, by enhancing manufacturing process controls to improve yields, by realizing price reductions from existing vendors, by qualifying new vendors and by reducing shipping costs. In addition, we believe additional opportunities to realize production efficiencies and to reduce per unit overhead costs will arise with growth in the scale of our manufacturing operations. Our objective is both to reduce costs to enhance our competitive advantage and to ensure we deliver high quality finished products to our customers.

Research and Development

The mission of our research and development team is to leverage our aerogel technology platform in support of our commercial objectives. In our existing markets, research and development personnel design new and improved insulation products to enhance our value to customers and to expand our revenue potential. Our materials scientists and engineers also seek to develop enhanced chemical and process technologies to improve yields, lower manufacturing costs and improve product performance. In new markets, research and development personnel seek to exploit the unique characteristics of aerogels, including low thermal conductivity, high surface area, high electrical conductivity, and tunable porosity, to develop aerogel-enhanced products and next generation technology addressing complex and unmet market needs.

Our research and development expenditures were \$8.7 million, \$8.4 million and \$6.3 million for the years ended December 31, 2020, 2019 and 2018, respectively. In addition, we spent \$0.1 million, \$1.3 million and \$1.0 million for the years ended December 31, 2020, 2019 and 2018, respectively, on research and development activities sponsored by federal and other government agencies.

Contract Research and Government Support

We have received funding from a number of federal and other government agencies in support of our research and development and manufacturing activities. Research performed under contract to the Department of Defense, the Department of Energy and other institutions allowed us to develop and leverage technologies into broader commercial applications. We also worked closely with customers in government and industry to develop potential aerogel solutions that leveraged not only the thermal insulation performance but other benefits of aerogels as well.

In late 2019, we decided to wind down our existing contract research activities. This decision reflected our desire to focus our research and development resources on initiatives to improve the profitability of our existing business and on efforts to develop new products and next generation technology with application in new, high value market segments.

We have received \$58.7 million in funding under government contracts from inception through December 31, 2020. Our contract research revenue was \$0.4 million, \$2.4 million and \$2.2 million for the fiscal years ended December 31, 2020, 2019 and 2018, respectively.

Intellectual Property

Our success depends in part upon our ability to obtain, maintain and enforce intellectual property rights that cover our aerogel technology platform, including, product forms, applications and/or manufacturing technologies and the technology or know-how that enables these product forms, applications, technologies and specifications, to avoid and defend against claims that we infringe the intellectual property rights of others, and to prevent the unauthorized use of our intellectual property. Since aerogels were developed more than 80 years ago, there has been a wide range of research, development and publication on aerogels and related technologies, which make it difficult to establish intellectual property rights to many key elements of aerogel technology and to obtain meaningful patent protection. Where appropriate, we seek to protect our rights by filing patent applications in United States and other key foreign jurisdictions related to products, processes, technology and improvements that we consider patentable and important to our business and, in particular, our aerogel technology, product forms and their applications in promising markets and our manufacturing technologies. We also rely on trade secrets, trademarks, licensing agreements, confidentiality and nondisclosure agreements and continuing technological innovation to safeguard our intellectual property rights and develop and maintain our competitive edge.

As of December 31, 2020, we owned 49 issued U.S. patents, 29 pending U.S. patent applications (including seven issued U.S. patents and two pending U.S. patent application that we co-own with third parties), 95 issued foreign patents, 84 pending foreign patent applications (including 23 issued foreign patents and ten pending foreign patent applications that we co-own with third parties), and one allowed foreign patent. The patents that we own are generally effective for 20 years from the filing date of the earliest application to which each U.S. patent claims priority. The scope of each of our foreign patents varies in accordance with local law. Our early product patent family covering a fiber-reinforced aerogel composition will expire in December 2021.

In May 2016, we filed a complaint for patent infringement against Nano Tech Co., Ltd. (Nano), and Guangdong Alison Hi Tech., Ltd. (Alison) in the International Trade Commission, or ITC. In February 2018, the ITC issued its final determination that Nano and Alison had infringed asserted Aspen patents and that they have not proven the patents are invalid except with respect to one dependent product claim, which the ITC found was not infringed. The ITC affirmed that Alison and Nano each violated Section 337 of the Tariff Act and issued a limited exclusion order prohibiting importation of infringing aerogel insulation products manufactured by Alison and Nano. Alison's appeal with respect to a product patent to the United States Court of Appeals for the Federal Circuit (CAFC) was rejected, and resulted in CAFC affirming the validity of our patent. The exclusion order, which is enforced by the United States Customs and Border Protection, is currently in effect.

Additionally, the USPTO denied Alison's requests to invalidate the claims of four of our patents in Inter-Partes Review. Alison also filed multiple similar requests with the Chinese Patent Office (SIPO), seeking to invalidate our Chinese manufacturing process patents and two of our Chinese product patents. With respect to one of those requests, not withdrawn previously by Alison, the Patent Review Board of SIPO (PRB), issued a decision upholding the validity of Aspen's issued patent as amended in the proceedings. Alison has appealed the PRB's decision to the Beijing IP court. On July 25, 2020, the Beijing IP court dismissed Alison's appeal and upheld the validity of Aspen's patent and we received this decision on September 15, 2020. Nano has also filed a request seeking invalidation of a product patent at SIPO. After the oral hearing at PRB, Nano withdrew its invalidation request. On September 23, 2019, Alison filed yet another request to invalidate the same patent, whose validity was previously confirmed by PRB. On January 23, 2020 PRB denied Alison's latest invalidation request.

In April 2016, we also filed a patent infringement suit at the District Court in Mannheim, Germany (Mannheim court), against Nano, Alison and two European resellers asserting their infringement of one of our German patents. We subsequently asserted infringement of another three patents against Nano, Alison and a European reseller of Alison's products at the Mannheim court. We have since settled with one European reseller in exchange for a commitment not to procure infringing products and cooperation with our case. In January 2018, the court issued a series of judgments by acknowledgement (German, "Anerkenntnisurteil") finding the second reseller, Hiltex, liable for infringement and also issued injunctions against Hiltex. The judgments resulted from a settlement agreement in which Hiltex agreed not to resell the infringing products in Europe where at least one of the asserted patents are active. On March 8, 2019, the Mannheim court issued two separate judgments in cases against Nano and Alison, respectively. The Mannheim court determined that both Nano and Alison are infringing on Aspen's EP1638750 (750 Patent) in connection with their respective products. The court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing the infringing products. The court found the defendants liable to us for damages since September 22, 2012. The court also ordered the defendants to provide information on the scope of the acts of infringement committed since August 22, 2012, and a recall of infringing products. The court ordered Nano and Alison to bear the costs of the legal proceedings and reimburse statutory attorneys' costs and expenses to us, that exact amount of which is yet to be determined. Nano and Alison have appealed the judgments of the Mannheim court. Nano subsequently withdrew the appeal while Alison's appeal is currently pending.

The Mannheim court issued two decisions on December 23, 2019 finding that Alison infringed the 577 Patent and the 950 Patent and also issued injunctions prohibiting Alison from continuing infringement in connection with any aerogel sheets. The December 2019 decisions against Alison have now become final and binding. The Mannheim court issued two decisions on July 31, 2020 finding that Nano infringed each of the 577 Patent and the 950 Patent. In addition to granting other remedies, the court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing any aerogel sheets. After the passing of deadline to file appeals, these decisions have now become final.

Nano and Alison also initiated nullity actions in German Federal Patent Court in Munich against our asserted German patents. On September 25, 2018, the Federal Patent Court in Munich dismissed the challenge to the validity of 750 Patent which has subsequently become final. Nano and Alison also filed an opposition to one of the asserted patents at the EPO. In December 2018, the opposition division of EPO determined the patent, EP2813338 (338 Patent), was invalid on formality grounds and decided to revoke it, which determination is currently under appeal at the EPO Board of appeals. On March 19 and 20, 2019 the German Federal Patent Court in Munich (FPC) conducted oral proceedings and voided four claims in EP2415577 (577 Patent) and confirmed the validity of challenged claims in EP2422950 (950 Patent) within the scope of silica gels. These FPC judgments are now final and binding on the parties. Nano had filed another nullity action seeking to invalidate the remaining claims in the 577 Patent which action Nano subsequently failed to pursue. On June 17, 2020, Nano also filed an opposition to a recently issued Aspen Patent EP3120983B1, titled "Continuous Sheet of Gel Materials and Continuous sheet of Aerogel".

Additionally, a reseller of Nano's products in Taiwan challenged the validity of one of our patents in Taiwan in 2018. After careful review of our written response, the Taiwanese patent office has determined the patent as valid and dismissed the challenge in December 2018. In 2018, LG Chem Ltd. challenged the validity of one of our patents in Korea at the IPTAB of the Korean Intellectual Property Office. After conducting an oral hearing, the IPTAB issued a decision on November 30, 2019 upholding claims related to aerogel sheets incorporating fibers. On January 14, 2021 the Korean Patent Court confirmed the validity of the claims related to aerogel sheets incorporating fibers.

Due to their nature, it is difficult to predict the outcome or the costs involved in any litigation. Furthermore, our adversaries may have significant resources and interest to litigate and therefore, these litigation matters could be protracted and may ultimately involve significant legal expenses. We have incurred approximately \$9.3 million of expenses related to this litigation since 2015 through December 31, 2020. In addition to the foregoing, we have been and may be from time to time party to other legal proceedings that arise in the ordinary course of business and to other patent enforcement actions to assert our patent rights.

We believe that having distinctive names is an important factor in marketing our products, and therefore we use trademarks to brand some of our products, including Pyrogel, PyroThin, Cryogel and Spaceloft. As of December 31, 2020, we had five trademark registrations in the United States, one trademark registration with the World Intellectual Property Organization, and 54 trademark registrations in foreign jurisdictions, including the European Union, Japan, China, Canada, South Korea and Brazil. Additionally, we had seven pending foreign trademark applications. Although we have a foreign trademark registration program for selected marks, our approach may not be comprehensive and we may not be able to register or use such marks in each foreign country in which we seek registration.

Cross License Agreement with Cabot Corporation

In April 2006, we entered into a cross license agreement with Cabot Corporation, as amended in September 2007, in which each party granted certain intellectual property rights to the other party. The cross license agreement remains in effect until the expiration of the last to expire of the issued patents or patent applications and acquired patents licensed thereunder. We hold a non-exclusive, worldwide license to those patents and patent applications owned or licensed by Cabot that are necessary for us to (i) practice our manufacturing technology within a field of use, which is defined in accordance with the specific chemistry of our aerogel products and the supercritical fluid technology that we use in our manufacturing technology and (ii) use and sell the resulting aerogel blanket and derivative products. We paid Cabot \$38 million over a period of approximately seven years, with the last payment made in March 2013, in connection with this license agreement. We have granted to Cabot a reciprocal, non-exclusive, worldwide license to certain patents and patent applications that we own that are necessary for Cabot to practice its processes within a field of use defined in accordance with the specific chemistry in its aerogel products and the drying technology that it uses to manufacture its products. The grant of license to each party covers issued patents, patent applications and patents issued from such counterpart applications, as well as patents licensed or acquired during a specified period, in each case that claim aerogels, or methods, materials of manufacture, or uses of aerogels.

Our Company

We are a corporation organized under the laws of Delaware. We own three wholly owned subsidiaries: Aspen Aerogels Rhode Island, LLC, Aspen Aerogels Germany, GmbH and Aspen Aerogels Georgia, LLC, which was formed in August 2016. We maintain our corporate offices in Northborough, Massachusetts.

On June 18, 2014, we completed our initial public offering, or IPO, of 7,500,000 shares of our common stock at a public offering price of \$11.00 per share. On February 18, 2020, we completed an underwritten public offering of 1,955,000 shares of our common stock at a public offering price of \$8.25 per share. We received net proceeds of \$14.8 million after deducting underwriting discounts and commissions of \$1.1 million and offering expenses of approximately \$0.3 million. On November 5, 2020, we entered into a sales agreement with B. Riley Securities, Inc. with respect to an at-the-market ("ATM") offering program under which we may offer and sell, from time to time in our sole discretion, shares of our common stock, through B. Riley Securities as our sales agent. During November and December 2020, we issued 714,357 shares of our common stock at an average price of \$13.96 per share through the at-the-market offering and received net proceeds of \$9.5 million after deducting commissions \$0.3 million and offering expenses of approximately \$0.2 million.

As of March 9, 2021, we had 28,301,338 shares of our common stock outstanding.

We are required to file annual, quarterly and current reports, proxy statements and other information required by the Securities Exchange Act of 1934, as amended, or the Exchange Act, with the Securities and Exchange Commission, or the SEC. SEC filings are available at the SEC's website at https://www.sec.gov.

We maintain a public website at https://www.aerogel.com and use our website as a means of disclosing material non-public information and for complying with our disclosure obligations under Regulation FD. Our website includes an Investors section through which we make available, free of charge, our Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K, Proxy Statements and Forms 3, 4 and 5 filed on behalf of directors and executive officers, as well as any amendments to those reports filed or furnished pursuant to the Exchange Act as soon as reasonably practicable after we electronically file such material with, or furnish it to, the SEC. The members of our Board of Directors and the designated chairs of the committees of the Board of Directors are reflected on the signature page of this annual report on Form 10-K. We also make available on our website the charters for our Board of Directors' Audit Committee, Compensation and Leadership Development Committee and Nominating and Corporate Governance Committee, as well as our Code of Business Conduct and Ethics, our Corporate Governance Guidelines and other related materials. The information on our website is not part of this annual report.

Our Investor Relations Department can be contacted at Aspen Aerogels, Inc., 30 Forbes Road, Building B, Northborough, MA 01532, Attention: Investor Relations; telephone: 508-691-1111; e-mail: ir@aerogel.com.

Employees

As of December 31, 2020, we had 290 full-time employees with 36 in research and development, 179 in manufacturing operations and supply chain, 46 in sales and marketing and 29 in general and administrative functions. Of our employees, 274 are located in the United States and 16 are located abroad. We consider our current relationship with our employees to be of good standing. None of our employees are represented by labor unions or have collective bargaining agreements.

Seasonality

Our industry and product offering makes us less susceptible to seasonal patterns as our operating results are generated in part by demand for insulation associated with new-build construction of facilities, capital expansions and related capital projects, and larger maintenance-related projects in the energy infrastructure market. Historically, our third and fourth quarter results have shown increased levels of revenue, which we believe is associated with our end-use customers' maintenance schedules and timing of capital projects.

Environmental Matters

We are subject to federal, state, local and foreign laws and regulations designed to protect the environment and to regulate the discharge of materials into the environment. We believe that our policies, practices, and procedures are properly designed to prevent unreasonable risk of environmental damage and associated financial liability. To date, environmental control regulations have not had a significant adverse effect on our overall operations. See "Risk Factors — We may incur significant costs complying with environmental, health and safety laws and related claims, and failure to comply with these laws and regulations could expose us to significant liabilities, which could adversely affect our results of operations."

Item 1A. RISK FACTORS

Summary of Risk Factors

Our business is subject to numerous risks and uncertainties, including those highlighted in this section below, that represent challenges that we face in connection with the successful implementation of our strategy. The occurrence of one or more of the events or circumstances described in more detail in the risk factors below, alone or in combination with other events or circumstances, may have an adverse effect on our business, cash flows, financial condition and results of operations. Such risks include, but are not limited to:

- We have incurred annual net losses since our inception, and we may continue to incur net losses in the future and may never reach profitability.
- We have yet to achieve positive total cash flow, and our ability to generate positive cash flow is uncertain.
- Our working capital requirements involve estimates based on demand and production expectations and may decrease or increase beyond those currently anticipated, which could materially harm our results of operations and financial condition.
- Our revolving credit facility contains financial and operating restrictions that may limit our access to credit.
- We will require significant additional capital to pursue our growth strategy, but we may not be able to obtain additional financing on acceptable terms or at all
- Shortages of the raw materials used in the production of our products, increases in the cost of such materials or disruptions in our supply chain could have a material adverse impact on our financial condition and results of operations.
- Our business, results of operations and financial condition could be materially adversely affected by the effects of widespread public health epidemics, including coronavirus and the resulting COVID-19 pandemic, that are beyond our control.
- We are dependent on a single manufacturing facility. Any significant disruption to this facility or the failure of any one of our three production lines in this facility to operate according to our expectation could have a material adverse effect on our business and results of operations.
- A sustained downturn in the energy industry, due to lower oil and gas prices or reduced energy demand, could decrease demand for some or all of our
 products and services, which could have a material adverse effect on our business, financial condition and results of operations.
- Regulation of greenhouse gas emissions could reduce demand for hydrocarbon products and lead to a sustained downturn in the energy industry, which could decrease demand for our products and have a material adverse effect on our business, financial condition and results of operation.
- The market for insulation products incorporating aerogel blankets is relatively undeveloped and our products may never be widely adopted, which would have a material adverse effect on our business.
- The insulation market we serve is highly competitive. If we are unable to compete successfully, we may not be able to increase or maintain our market share and revenues.
- We have entered into and may enter into future agreements that may limit our ability to broadly market our products or could involve future obligations, which could make it more difficult for us to commercialize certain of our products and negatively affect our business and results of operations.
- The qualification process for our products can be lengthy and unpredictable, potentially delaying adoption of our products and causing us to incur significant expense potentially without recovery.
- Our revenue may fluctuate, which may result in a high degree of variability in our results of operations and make it difficult for us to plan based on our future outlook and to forecast our future performance.
- The results of our operations could be materially adversely affected if our operating expenses incurred do not correspond with the timing of our revenues.
- If we fail to achieve the increase in production capacity that our long-term growth requires in a timely manner, or at all, our growth may be hindered and our business or results of operations may be materially adversely affected.
- If the expected growth in the demand for our products does not follow after each of our planned capacity expansions, then our business will be materially adversely affected.
- A substantial portion of our revenue comes from sales in foreign countries and we may expand our operations outside of the United States, which subjects
 us to increased economic, trade, foreign exchange, operational and political risks that

could materially adversely impact our business, financial conditions and results of operations and also increase our costs and make it difficult for us to operate profitably.

- A failure to comply with export control or economic sanctions laws and regulations could have a material adverse impact on our business, results of operations or financial condition. We may be unable to ensure that our distributors comply with applicable sanctions and export control laws.
- Our activities and operations are subject to numerous health and safety laws and regulations. If we violate such regulations, we could face penalties and fines or be required to curtail or cease operations.
- We may face certain product liability or warranty claims on our products, including from improper installation of our products by third parties. As a consequence, we could lose existing and future business and our ability to develop, market and sell our insulation could be harmed.
- We may incur significant costs complying with environmental, health and safety laws and related claims, and failure to comply with these laws and regulations could expose us to significant liabilities, which could materially adversely affect our results of operations.
- Breakdowns, security breaches, loss of data and other disruptions of our information technology systems could compromise sensitive information related to our business, prevent us from accessing critical information and expose us to liability, which would cause our business and reputation to suffer.
- If we lose key personnel upon whom we are dependent, or if we are unable to successfully recruit and retain skilled employees, we may not be able to manage our operations and meet our strategic objectives.
- Our ability to use our net operating loss carryforwards may be subject to limitation, which could result in a higher effective tax rate and adversely affect our financial condition and results of operations.
- Our inability to protect our intellectual property rights could negatively affect our business and results of operations.
- We have initiated intellectual property litigation that is and will continue to be costly, and could limit or invalidate our intellectual property rights, divert time and efforts away from business operations, require us to pay damages and/or costs and expenses and/or otherwise have an material adverse impact on our business, and we could become subject to additional such intellectual property litigation in the future.
- Our contracts with the U.S. government and other third parties could negatively affect our intellectual property rights.
- We rely on trade secrets to protect our technology, and our failure to obtain or maintain trade secret protection could materially adversely affect our competitive business position.
- We have incurred and will continue to incur increased costs and demands upon management as a result of complying with the laws and regulations affecting public companies in the United States, which may adversely affect our results of operations.
- Because we are a public company, we are obligated to develop and maintain proper and effective internal control over financial reporting. If our internal controls over financial reporting are determined to be ineffective, or if our auditors are otherwise unable to attest to their effectiveness, investor confidence in our company, and our common stock price, may be adversely affected.
- Our shareholders may experience future dilution as a result of future equity offerings.

Risks Related to Our Business and Strategy

We have incurred annual net losses since our inception, and we may continue to incur net losses in the future and may never reach profitability.

We have a history of losses, and we may not ever achieve full year profitability. We experienced net losses of \$21.8 million, \$14.6 million and \$34.4 million for the years ended December 31, 2020, 2019 and 2018, respectively. As of December 31, 2020, our accumulated deficit was \$508.0 million. We expect to continue to incur operating losses as a result of expenses associated with the continued development and expansion of our business. Our expenses include research and development, sales and marketing, and general and administrative costs. Furthermore, these expenses are not the only factors that may contribute to our net losses. For example, interest expense that we incur on any future financing arrangements could contribute to our net losses. Any failure to increase revenue or manage our cost structure as we implement initiatives to grow our business could prevent us from achieving profitability, or sustaining profitability if we do achieve it. In addition, our ability to achieve profitability is subject to a number of risks and uncertainties discussed below, many of which are beyond our control. Failure to become and remain profitable may adversely affect the market price of our common stock and our ability to raise capital and continue operations.

We have yet to achieve positive total cash flow, and our ability to generate positive cash flow is uncertain.

To develop and expand our business, we have made significant up-front investments in our manufacturing capacity and incurred research and development, sales and marketing and general and administrative expenses. In addition, our growth has required a significant investment in working capital. We experienced negative cash flows from operating activities of \$9.9 million, \$1.1 million and \$8.7 million for the years ended December 31, 2020, 2019 and 2018, respectively. The negative cumulative cash flows from operating activities during the three-year period were exacerbated by cash flows used in investing activities to maintain, enhance and expand our manufacturing operations during the same time period. As a result, we experienced negative total cash flows during the three-year period.

We expect our operating cash flow will be negative on an annual basis during 2021. In addition, we anticipate significant cash outlays related to maintaining our manufacturing operations in our East Providence facility. As a result, we project that our existing cash balance alone may periodically be insufficient to fund these working capital requirements during the year. During such periods, we may be dependent on our line of credit with Silicon Valley Bank, or SVB, under which we have the ability to borrow up to \$20.0 million, to fund the balance of the required investment in working capital. The credit agreement requires us to comply with both non-financial and financial covenants, which have included minimum Adjusted EBITDA and during previous renewal periods, minimum Adjusted Quick Ratio covenants, as defined in the credit agreement. In May 2018, August 2018, November 2018, December 2018, and December 2020 we obtained waivers from SVB related to our compliance with these financial covenants. These waivers were subject to certain conditions, including, in the case of the November 2018 waiver, the Company's issuance of \$3.25 million in equity or receipt of \$5.0 million in customer advanced payments on or before January 31, 2019. Although we met these conditions, including in connection with the November 2018 waiver upon receipt on January 30, 2019 of a \$5.0 million advanced payment from BASF, there can be no assurance that we will continue to comply with such covenants or that SVB will waive such potential or actual non-compliances, if requested, or waive them with reasonable and achievable conditions. As a result, we could end up in default under the agreement or otherwise be unable to continue to borrow under our line of credit, subject to acceleration of the payment of any balance and further subject to the remedies typically available to a lender. See "Our revolving credit facility contains financial and operating restrictions that may limit our access to credit. In addition, our revolving credit facility

In addition, we may not achieve sufficient revenue growth to generate positive cash flow in 2022 or beyond. Furthermore, the amounts available under our line of credit with SVB may be insufficient to fund periodic working capital requirements during the year. As a result, we may need to raise additional capital from investors to achieve our expected growth or to fund the working capital investment necessary to maintain operations. Any inability to generate positive future cash flow, to borrow funds or to raise additional capital on reasonable terms, if at all, may harm our short-term financial condition or threaten our long-term viability.

Our working capital requirements involve estimates based on demand and production expectations and may decrease or increase beyond those currently anticipated, which could materially harm our results of operations and financial condition.

In order to fulfill the product delivery requirements of our direct and end-use customers, we plan for working capital needs in advance of customer orders. As a result, we base our funding and inventory decisions on estimates of future demand. If demand for our products does not increase as quickly as we have estimated or drops off sharply, our inventory and expenses could rise, and our business and results of operations could suffer. Alternatively, if we experience sales in excess of our estimates, which has materialized in previous reporting periods, our working capital needs may be higher than those currently anticipated. Our ability to meet this excess customer demand depends on our ability to arrange for additional financing for any ongoing working capital shortages, since it is likely that cash flow from sales will lag behind these investment requirements. In the past, we have principally relied on our line of credit with SVB to supplement these financing needs. The revolving credit agreement requires us to comply with both non-financial and financial covenants. During 2018, we failed on three occasions to comply with a single liquidity related financial covenant, but we were able to obtain waivers on all three occasions from SVB with respect to our compliance with this covenant and ultimately, comply with the conditions of the waivers. In the future, there can be no assurance that we will continue to comply with such covenants and that SVB will waive such non-compliance, if requested. As a result, we could end up in default under the agreement or otherwise be unable to continue to borrow under our line of credit. Any failure to borrow under our line credit when needed could adversely affect our ability to invest in the working capital required to maintain and grow our business.

Our revolving credit facility contains financial and operating restrictions that may limit our access to credit. In addition, our revolving credit facility expires on April 28, 2022 and we may not be able to renew, extend or replace the expiring facility. If we fail to comply with covenants in our revolving credit facility or if facility is terminated, we may be required to repay our indebtedness thereunder, which may have an adverse effect on our liquidity.

Provisions governing our revolving credit facility impose restrictions on our ability to operate, including, for some of the agreements and instruments, but not for others, our ability to:

- incur capital expenditures;
- incur additional debt;
- pay dividends and make distributions;
- redeem or repurchase capital stock;
- create liens;
- enter into transactions with affiliates; and
- merge or consolidate with or into other entities.

Our revolving credit facility also contains other financial and non-financial covenants. We may not be able to comply with these covenants in the future. Our failure to comply with these covenants may result in the declaration of an event of default and could cause us to be unable to borrow funds under our revolving credit facility. In addition to preventing additional borrowings under our revolving credit facility, an event of default, if not cured or waived, may result in the acceleration of the maturity of indebtedness outstanding under the revolving credit facility, which would require us to pay all amounts outstanding. Such an event may also lead our lender to exercise its security interest in our assets, including all of our real property and equipment at our East Providence facility. If an event of default occurs, we may not be able to cure it within any applicable cure period, if at all. If the maturity of our indebtedness is accelerated, we may not have sufficient funds available for repayment or we may not have the ability to borrow or obtain sufficient funds to replace the accelerated indebtedness on terms acceptable to us, or at all.

We will require significant additional capital to pursue our growth strategy, but we may not be able to obtain additional financing on acceptable terms or at all.

The growth of our business will depend on substantial amounts of additional capital for expansion of existing production lines or construction of new production lines or facilities, for ongoing operating expenses, for continued development of our aerogel technology platform, or for introduction of new product lines. Our capital requirements will depend on many factors, including the rate of our revenue growth, our introduction of new products and technologies, our enhancements to existing products and technologies, and our expansion of sales and marketing and product development activities. In particular, our plans to potentially expand capacity beyond our existing facility in East Providence, Rhode Island are dependent on our ability to raise debt and issue equity. In addition, in connection with our plan to penetrate the electric vehicle market, we anticipate that we will need to construct a state-of-the-art thermal barrier fabrication operation, hire dedicated thermal barrier fabrication employees, and increase our aerogel blanket manufacturing capacity to keep pace with the significant potential demand for our PyroThin thermal barriers from the electric vehicle market. Any such significant expansion of our aerogel capacity will require us to raise substantial amounts of additional capital. There is no assurance that we will be able obtain any such type of financing on terms acceptable to us or at all and in a timely manner.

In addition, we may consider strategic acquisitions of complementary businesses or technologies to grow our business, which would require significant capital and could increase our capital requirements related to future operation of the acquired business or technology.

We may not be able to obtain loans or raise additional capital on acceptable terms or at all. Our revolving credit facility with SVB contains restrictions on our ability to incur additional indebtedness, which, if not waived, could prevent us from obtaining needed capital. In addition, our revolving credit facility is scheduled to mature on April 28, 2022. Any future credit facilities or debt instruments would likely contain similar or additional restrictions, requirements or conditions. We may not be able to obtain bank credit arrangements or effect an equity or debt financing on terms acceptable to us or at all in order to fund our future capacity expansion plans. Any failure to obtain additional financing when needed could adversely affect our ability to maintain and grow our business.

Shortages of the raw materials used in the production of our products, increases in the cost of such materials or disruptions in our supply chain could have a material adverse impact on our financial condition and results of operations.

The raw materials used in the production of our products consist primarily of fiber battings, silica precursors and other additives. In addition, the production process requires the use of process gases and other materials typical to the chemical processing industry, as well as access to electricity, natural gas, water and other basic utilities. Although we are not dependent on a single supplier, we are dependent on the ability of our third-party suppliers to supply such materials on a timely and consistent basis. While these materials and utilities are available from numerous sources, they may be, and have been in the past, subject to fluctuations in availability and price. For example, during the year ended December 31, 2018, we experienced a significant increase in the costs of silica precursor materials, constituting over 50% of our raw material costs, which has continued through the year ended December 31, 2020.

Our third-party suppliers may not dedicate sufficient resources to meet our scheduled delivery requirements or our suppliers may not have sufficient resources to satisfy our requirements during any period of sustained or growing demand. Failure of suppliers to supply, delays in supplying or disruptions in the supply chain for our raw materials, or adverse allocations in the supply of certain high demand raw materials could materially adversely affect the results of our operations. Supply disruptions may affect our ability to meet our delivery schedules on a timely basis and materially negatively impact our results of operations. For example, in September 2015, pursuant to a force majeure notification, our primary carbon dioxide gas supplier temporarily curtailed supply of carbon dioxide to us due to a feedstock issue impacting the northeastern United States. During this period, the supply disruption required that we intermittently idle a portion of our manufacturing equipment thereby reducing our production volume and adversely impacting our results of operation.

While we have recently entered into a three-year contract to secure exclusive supply of certain silanes from Silbond Corporation, most of our raw materials are procured through individual purchase orders or short-term contracts and not through long-term contracts that ensure a fixed price or guaranteed supply for an extended period of time. This procurement strategy may not support sustained long-term supply chain stability. Fluctuations in the prices of these raw materials could have a material adverse effect on our results of operations. Our suppliers also seek alternative uses for our raw materials at higher price points. Such competitive uses for our raw materials create material price and availability risks to our business. In addition, our ability to pass increases in raw material prices on to our customers is limited due to competitive pricing pressure and the time lag between the increase in costs and the implementation of related price increases.

In particular, we purchase a variety of silica precursors from several suppliers, mostly pursuant to individual purchase orders or short-term contracts and not pursuant to long-term contracts. We do not have a secure, long-term supply of silica precursors. We may not be able to establish arrangements for secure, long-term silica precursor supplies at prices consistent with our current costs or may incur a delay in supply while we seek alternative sources. From time-to-time, we experienced a significant increase in the price of certain silica precursors due to a supply imbalance or other factors in the silanes market. While we seek to reformulate our products to reduce our reliance on materials that are susceptible to significant price fluctuations, while maintaining appropriate performance characteristics, our efforts may not be successful. Any inability to continue to purchase silica precursors without long-term agreements in place, or to otherwise establish a long-term supply of silica precursors at prices consistent with our current cost estimates, would have a material adverse effect on our ability to increase our sales and achieve profitability.

Additionally, our suppliers may prioritize their resources for any long-term commitments to third parties and to our detriment. We may not be in a position to find alternate suppliers in a timely manner to continue to operate consistent with our obligations to or expectations of our customers. The supply chain for our materials has been increasingly global in nature. The global events like trade wars between nations or corona virus outbreak could have both short-term and long-term effects on our supply chain.

Our business, results of operations and financial condition could be materially adversely affected by the effects of widespread public health epidemics, including coronavirus and the resulting COVID-19 pandemic, that are beyond our control.

Any outbreaks of contagious diseases, public health epidemics and other adverse public health developments in countries where we, our customers and suppliers operate could have a material and adverse effect on our business, results of operations and financial condition. The recent novel strain of the coronavirus, initially limited to a region in China and now affecting the global community, including the United States, is expected to impact our operations, and the nature and extent of the impact may be highly uncertain and beyond our control. In particular, our sales globally, including to customers in the energy infrastructure and building materials markets that are impacted by the COVID-19 pandemic, are being negatively impacted as a result of disruption in demand, which could have a material adverse effect on our business, results of operations and financial condition. The COVID-19 pandemic has led to unprecedented drops in the demand for oil, which compounded with an increase or announced increase in output of oil by certain oil exporting countries has resulted in significant volatility in the price of oil, which may severely impact the demand for our products used in energy infrastructure facilities. In response to this general uncertainty in the market for our products, we have taken a number of actions to reduce expenses, including wage reductions, temporary suspension of board fees and selected reductions to discretionary

expenses. In addition, as permitted by the CARES Act, we have elected to defer certain payments of the employer share of Social Security tax that would otherwise be required to be paid during the period beginning on March 27, 2020 and ending December 31, 2020. The CARES Act allows employers to deposit 50 percent of the deferred taxes on or before December 31, 2021, and the remaining 50 percent by December 31, 2022. We may also temporarily curtail operations in our East Providence, Rhode Island manufacturing facility if necessary to ensure the safety of our employees or to align capacity with demand. However, such actions or any future actions we take may not be sufficient to offset the effects of potential reduction in sales as a result of any disruption in demand. Furthermore, suppliers of our raw materials may not be able to supply the materials that we require to manufacture our products according to our schedules and specifications. If our suppliers' operations are impacted, we may need to seek alternate suppliers, which may be more expensive, may not be possible or may result in delays, each of which would affect the results of our operations. The duration of such a disruption, and related financial impact to us, cannot be accurately estimated at this time.

Uncertain factors relating to the COVID-19 pandemic include the duration of the outbreak, the severity of the disease, the effect of various mutated variants of the virus in circulation, availability of vaccines, the rate of vaccination in the various geographies, and the actions, or perception of actions that may be taken, to contain or treat its impact, including declarations of states of emergency, business closures, manufacturing restrictions and a prolonged period of travel, commercial and/or other similar restrictions and limitations. While the potential economic impact brought by and the duration of the coronavirus outbreak may be difficult to assess or predict, a widespread pandemic could result in significant or sustained disruption of global financial markets, reducing our ability to access capital, which could in the future negatively affect our liquidity. In addition, while we believe we have taken appropriate steps to maintain a safe workplace to protect our employees from contracting and spreading the coronavirus, including following the guidance set out from both the Occupational Safety and Health Administration and Centers for Disease Control and Prevention, we may not be able to prevent the spread of the virus among our employees, face litigation or other proceedings making claims related to unsafe working conditions, inadequate protection of our employees or other claims. Any of these claims, even if without merit, could result in costly litigation or divert management's attention and resources. Furthermore, we may face a sustained disruption to our operations due to one or more of the factors described above.

We are dependent on a single manufacturing facility. Any significant disruption to this facility or the failure of any one of our three production lines in this facility to operate according to our expectation could have a material adverse effect on our business and results of operations.

We have three production lines in a single manufacturing facility located in East Providence, Rhode Island. Our ability to meet the demands of our customers depends on efficient, proper and uninterrupted operations at this manufacturing facility. In the event of a significant disruption to our sole manufacturing facility or breakdown of any of the production lines, we currently do not expect that we would have sufficient inventory in stock to meet demand until the production lines return to operation.

Power failures or disruptions, the breakdown, failure or substandard performance of equipment, or the damage or destruction of buildings and other facilities due to fire or natural disasters could severely affect our ability to continue our operations. In the event of such disruptions, we are unlikely to find suitable alternatives or may not be able to make needed repairs on a timely basis and at reasonable cost, which could have a material adverse effect on our business and results of operations. In particular, our manufacturing processes include the use of high pressures, high temperatures and flammable chemicals, which subjects us to a significant risk of loss resulting from fire, spill or related event. We had occasional incidences of fires at our initial facility in Northborough, Massachusetts that preceded our current manufacturing facility in East Providence, Rhode Island.

If our manufacturing facility or any equipment therein were to be damaged or cease operations, it may reduce revenue, cause us to lose customers and otherwise adversely affect our business. The insurance policies we maintain to cover losses caused by fire or natural disaster, including business interruption insurance, may not adequately compensate us for any such losses and will not address a loss of customers that we expect would result or may have large deductibles insufficient to support our continuing operations. If our existing manufacturing facility was damaged or destroyed, we would be unable to operate our business for an extended period of time and our business and results of operations may be materially adversely affected, potentially even threatening our viability.

From time to time we have had difficulty in consistently producing products that meet applicable product specifications and technical and delivery requirements, and such difficulties could expose us to financial, contractual or other liabilities.

Our insulation products are technologically advanced and require a precise and complex manufacturing process. Because of the precision and complexity of this manufacturing process and the high-performance characteristics of our products, from time to time we have had difficulty in consistently producing products that meet applicable specifications and technical and delivery requirements, including, our customers' and the end-users' specifications and requirements. At certain times in the past, the growth in demand for our products has contributed to this difficulty by putting significant pressure on our management, our personnel and our production facilities. See "Risk Factors — Growth has placed significant demands on our management systems and our infrastructure. If we fail to manage our long-term growth effectively, we may be unable to execute our business plan, address competitive challenges and meet applicable product specifications and technical and delivery requirements."

Furthermore, we seek to lower our manufacturing costs, while maintaining appropriate performance characteristics, and to improve the per square foot costs of our silica aerogel blankets by optimizing our formulations to reduce material costs. Any failure to meet the specifications for our products as a result of our attempts to optimize our formulations, or otherwise, or technical and delivery requirements could result in the termination of existing customer contracts or purchase orders, the elimination or reduction of future purchase orders, the impairment of customer relationships, and the incurrence of financial, contractual or other liabilities. Products that do not meet these specifications or requirements may also expose us to warranty and product liability claims and associated adverse publicity. Any such termination, reduction, impairment, liability or publicity could result in a broader loss of existing customers and revenues and delay the execution of our business plans, disrupt our operations and could have a material adverse effect on our results of operations and financial condition.

A sustained downturn in the energy industry, due to lower oil and gas prices or reduced energy demand, could decrease demand for some or all of our products and services, which could have a material adverse effect on our business, financial condition and results of operations.

Demand for a significant portion of our products and services depends on the level of capital expenditure by companies in the energy industry, which depends, in part, on current and expected energy prices. Prices of oil and gas have been highly volatile in the past several years with oil prices reaching a high above \$100 per barrel in mid-2014 to a low below \$30 per barrel in early 2016. The volatility in oil prices and declines in oil prices, which are often associated with unrelated world events, have resulted, from time to time, in a reduction in capital expenditures by many companies in the energy industry, and in particular by end-users of our products involved in the construction and expansion of offshore and onshore oil and gas production facilities. Sustained lower energy prices may also reduce our end-users' need to improve energy savings by using premium-priced insulation products like ours, thus reducing demand for our products and causing downward pressure on the pricing of our products. A sustained downturn in the capital expenditures of our customers, whether due to periods of lower energy prices or a further decrease in the market price of oil and gas or otherwise, and including the perception that such a downturn might occur or continue, may delay capital projects, decrease demand for our products and cause downward pressure on the prices we charge for our products, which, in turn, could have a material adverse effect on our business, financial condition and results of operations. Such downturns, including the perception that they might occur or continue, could have a significant negative impact on the market price of our common stock.

Regulation of greenhouse gas emissions could reduce demand for hydrocarbon products and lead to a sustained downturn in the energy industry, which could decrease demand for our products and have a material adverse effect on our business, financial condition and results of operation.

Due to growing concerns about the risks of climate change, a number of countries are adopting or considering adopting regulations to reduce greenhouse gas emissions. The new U.S. administration has announced a renewed focus on potential legislation and regulations to combat climate change. Any potential greenhouse gas regulations, while potentially helpful in the adoption of electric vehicles, could have the impact of increasing energy costs, reducing the demand for hydrocarbons, decreasing profitability and return on investment in the energy industry, and leading to a sustained downturn in the energy industry. Demand for a significant portion of our products depends on the aggregate level of capital expenditure in the energy industry, which depends, in part, on the expected return on such investments. A sustained period of diminished returns or expected returns on capital deployed in the energy industry as a result of greenhouse gas regulations or otherwise, may delay capital projects, decrease demand for our products and cause downward pressure on the prices we charge for our products, which, in turn, could have a material adverse effect on our business, financial condition, results of operations and the market price of our common stock.

The markets we serve are subject to general economic conditions and cyclical demand, which could harm our business and lead to significant shifts in our results of operations from quarter to quarter that make it difficult to project long-term performance.

Our results of operations have been, and may in the future be, adversely affected by general economic conditions and the cyclical pattern of certain industries in which our customers and end-users operate. Demand for our products and services depends in large part upon the level of capital and maintenance expenditures by many of our customers and end-users, in particular those in the energy, petrochemical and power generation industries, and firms that design, construct and operate facilities for these industries.

These customers' expenditures historically have been cyclical in nature and vulnerable to economic downturns. In particular, profitability in the energy industry is highly sensitive to supply and demand cycles and commodity prices, which historically have been volatile; and our customers in this industry historically have tended to delay large capital projects, including expensive maintenance and upgrades, during industry downturns. Delays in customer projects may cause fluctuations in the timing or the amount of revenue earned and our results of operations in a particular period. Prolonged periods of little or no economic growth could decrease demand for oil and gas which, in turn, could result in lower demand for our products and a negative impact on our results of operations and cash flows. This risk increases as we seek to increase the project-based revenue as a percentage of the total revenue. In addition, this cyclical demand and potential customer project delays may lead to significant shifts in our results of operations from quarter to quarter and from year to year, which limits our ability to make accurate long-term predictions about our future performance.

We estimate that sales to end-use customers in the energy industry accounted for approximately 95% of our 2020 revenues and we expect that they will continue to account for a significant portion of our future revenues.

The market for insulation products incorporating aerogel blankets is relatively undeveloped and our products may never be widely adopted, which would have a material adverse effect on our business.

The market for insulation products utilizing aerogel blankets is relatively undeveloped. Accordingly, our future results of operations will depend in large part on our ability to gain market share of the global energy infrastructure insulation market. Our ability to gain market share in this market is highly dependent on the acceptance of our products by large, well-established end-users, distributors, contractors and OEMs. The insulation market has historically been slow to adopt new technologies and products. Most insulation types currently in use in these markets were developed over 50 years ago. In addition, there is a tendency of end-users in some of our markets to opt for the lower short-term costs associated with traditional insulation materials. If we fail to successfully educate existing and potential end-users, distributors, contractors and OEMs of the benefits and value offered by our aerogel products, or if existing users of our products no longer rely on aerogel insulation for their insulation needs, our ability to sell our products and grow our revenue could be limited.

Our business strategy also includes the development of next generation products with the performance characteristics and price points required by markets outside the energy infrastructure and building materials markets, including the electric vehicle market. These performance and price requirements can be more demanding than those we faced in energy infrastructure and building materials markets. In the event that we are unable to develop products that meet market needs, we may be unable to successfully penetrate such markets. In addition, the innovative product and manufacturing methods development process requires the dedication of significant human, technical and financial resources, with no certainty of success or recovery of our related investment. As a result, we may be unable to grow our business in markets outside of the energy infrastructure and building materials markets, which could adversely affect our financial performance.

Because we are often a new supplier with new type of materials, to our end-use customers, we also may face concerns from these end-use customers about our reliability and our ability to produce our products in a volume sufficient to meet their supply and quality control needs. As a result, we may experience a reluctance or unwillingness by existing end-use customers to expand their use of our products and by potential end-use customers to begin using our products. Our products may never reach mass adoption, and changes or advances in technologies could adversely affect the demand for our products.

A failure to increase, or a decrease in, demand for aerogel insulation products caused by lack of end-user, market or distribution channel acceptance, technological challenges or competing technologies and products would result in a lower revenue growth rate or decreased revenue, either of which could have a material adverse effect on our business and our results of operations.

Our future growth in the electric vehicle market is dependent upon consumers' willingness to purchase and use electric vehicles.

Our future growth in the electric vehicle market is highly dependent upon the purchase and use by consumers of electric vehicles. If the market for electric vehicles does not gain broad market acceptance or develops more slowly than we expect, our business, prospects, financial condition and operating results will be harmed. The market for electric vehicles is relatively new, rapidly evolving, characterized by rapidly changing technologies, price competition, additional competitors, evolving government regulation and industry standards, frequent new vehicle announcements, long development cycles for electric vehicles original equipment manufacturers and changing consumer demands and behaviors. Factors that may influence the purchase and use of electric vehicles include:

- perceptions about electric vehicle quality, safety (in particular with respect to lithium-ion battery packs), design, performance and cost, especially if adverse events or accidents occur that are linked to the quality or safety of electric vehicles;
- perceptions about vehicle safety in general, in particular safety issues that may be attributed to the use of advanced technology, including vehicle electronics and regenerative braking systems;
- the decline of an EV's range resulting from (i) deterioration over time in the battery's ability to hold a charge (ii) operation in colder weather;
- concerns about electric grid capacity and reliability, which could derail efforts to promote electric vehicles as a practical solution to vehicles that require
 gasoline;
- the environmental consciousness of consumers;
- volatility in the cost of oil and gasoline;

- safety concerns around electric vehicles generally and battery systems in particular; and
- access to charging stations, standardization of electric vehicles charging systems and consumers' perceptions about convenience and cost to charge an electric vehicles:

The influence of any of the factors described above may cause current or potential customers not to purchase electric vehicles and could impact the widespread consumer adoption of electric vehicles, which would materially adversely affect our business, operating results, financial condition and prospects.

Our products are expensive relative to other insulation products, which could make it more difficult for us to grow our revenue and achieve broader adoption of our aerogel products.

While we believe our products have superior performance attributes and may sometimes have the lowest cost on a fully-installed basis or offer life-cycle cost savings, our competitors offer many traditional insulation products that are priced below our products. Our products are expensive relative to alternative insulation products and end-use customers may not value our products' performance attributes sufficiently to pay their premium price. This could make it more difficult for us to grow our revenue and achieve broader adoption of our aerogel products. While we seek to lower our manufacturing costs, while maintaining appropriate performance characteristics, and to improve the per square foot costs of our silica aerogel blankets by optimizing our formulations to reduce material costs, we may not be successful in doing so. In addition, some of the benefits of our products are based on reduced installation time and related labor expense. In regions where labor costs are significantly lower than in the United States and Europe, the cost benefits of reduced installation times may not be adequate to overcome the relatively high price of our products and may make it more difficult for us to grow our revenue in those regions.

The insulation market we serve is highly competitive. If we are unable to compete successfully, we may not be able to increase or maintain our market share and revenues.

We face strong competition primarily from established manufacturers of traditional insulation materials. Large producers of traditional insulation materials, such as Johns Mansville, Saint-Gobain, Knauf Gips, Owens Corning and Rockwool, dominate the insulation market. In addition, we face increasing competition from other companies seeking to develop high-performance insulation materials, including aerogel insulation. For example, Cabot Corporation manufactures, markets and sells a different form of aerogel insulation that is competitive with our products, particularly in the offshore oil and gas sector for use in pipe-in-pipe applications. We are also aware of competitors including Armacell International S.A., Guangdong Alison Hi-Tech Co, Ltd, Nano Tech Co, Ltd, and other Asia-based companies which manufacture and/or market aerogel insulation products in blanket form. Many of our competitors are substantially larger and better capitalized than we are and possess greater financial resources. Our competitors could focus their substantial financial resources to develop new or additional competing products or develop products that are more attractive to potential customers than the products that we offer. We expect to face an increasing amount of competition in the aerogel insulation market over the next several years as existing competitors and new entrants seek to develop and market their own aerogel products.

Because some insulation manufacturers are substantially larger and better capitalized than we are, they may have the ability to sell their products at substantially lower costs to a large, existing customer base. Our products are expensive relative to other insulation products and end-use customers may not value our products' superior performance attributes sufficiently to pay their premium price. In addition, from time to time we may increase the prices for our products and these price increases may not be accepted by our end-use customers and could result in a decreased demand for our products. Similarly, we may make changes to our products in order to respond to customer demand or to improve their performance attributes and these changes may not be accepted by our end-use customers and could result in a decrease in demand for our products. These competitive factors could:

- make it more difficult for us to attract and retain customers;
- cause us to slow the rate of increase of our prices, delay or cancel planned price increases, lower our prices or discount our prices in order to compete;
- reduce our market share and revenues.

Any of these outcomes could have a material adverse effect on our results of operations, financial condition and cash flows.

Furthermore, we are in the early stages of developing industry-leading battery materials for lithium-ion battery systems in electric vehicles, using our patented carbon aerogel technology. Even assuming successful development of such industry-leading battery materials for the electric vehicles market, we will face substantial competition in commercializing such materials. We will compete with other companies, many of whom are developing or can be expected to develop products similar to ours. Our market is large with many competitors. Many of our competitors are more established than we are, and have significantly greater financial, technical, marketing, and other resources than we presently possess. Some of our competitors have greater name recognition and a larger customer base. These competitors may be able to respond more quickly to new or changing opportunities and customer requirements and may be able to undertake more extensive promotional activities, offer more attractive terms to customers, and adopt more aggressive pricing policies. We will not only compete with providers of other long-term solutions, such as lithium metal anode, but also with other well-engineered silicon rich anode materials provided by well-capitalized startups with longer experience with

silicon-based anodes. Thus, competing silicon-rich anode solutions, even if more expensive, may provide better mid-term solutions for increased energy densities before long-term solutions such as lithium metal anodes become viable. We cannot provide any assurance that we will be able to compete effectively with current or future competitors or that the competitive pressures we face will not harm our business, particularly as it relates to the electric vehicles market.

Failure by us to develop, maintain and strengthen strategic relationships with industry leaders to commercialize our products in the building materials market may adversely affect our results of operations and our ability to grow our business.

Our business strategy requires us to align the design and performance attributes of our products to the evolving needs of the market. To facilitate this process, we have sought out partnerships and relationships with industry leaders in order to assist in the development and commercialization of our products. We face competition from other manufacturers of insulation in seeking out and entering into such partnerships and relationships with industry leaders in our target markets and we may therefore not be successful in establishing strategic relationships in those markets.

In the building materials market, we have entered into an amended and restated supply agreement and an amended and restated side agreement (together, the supply agreement) with BASF Polyeurathanes GmbH, or BASF, and a joint development agreement with BASF SE. Pursuant to the supply agreement, we sell exclusively to BASF certain products at annual volumes to be specified by BASF, at its full discretion, subject to certain volume limits. BASF has no obligation to purchase any products under the supply agreement. The joint development agreement is designed to facilitate the collaboration between the parties on the development and commercialization of new products, which may not result in meaningful revenue contribution to our business.

In addition to the customary terms associated with supply agreements, BASF, in its sole discretion, may make prepayments to us in the aggregate amount of up to \$22.0 million during the term of the supply agreement. During 2018, BASF made prepayments to us of \$5.0 million. We secured our obligation to repay the prepayment with a first priority security interest in real estate, machinery and equipment located at our existing manufacturing facility in East Providence, Rhode Island. Additionally, we granted our subsidiaries non-exclusive licenses to our intellectual property as necessary to operate this machinery and equipment.

Beginning January 1, 2019, we are crediting 25.3% of any amounts that we invoice for Spaceloft A2 product sold to BASF against the outstanding balance of the 2018 prepayment. If any of the 2018 prepayment remains uncredited as of December 31, 2021, BASF may request that we repay the uncredited amount to BASF following a six-week notice period.

On January 15, 2019, we entered into an addendum to the supply agreement. The addendum provided for the inclusion of a newly developed product to be supplied to BASF under the supply agreement and for a second prepayment of \$5.0 million subsequently remitted by BASF to us on January 30, 2019.

Beginning January 1, 2020, we are required to credit up to 50% of any amounts that we invoice for the newly developed product sold to BASF against the outstanding balance of the 2019 prepayment. If any of the 2019 prepayment remains uncredited as of December 31, 2022, BASF may request that we either (i) credit 24.7% of any amounts we invoice for Spaceloft A2 product against the remaining balance of the 2019 prepayment, or (ii) repay the uncredited balance to BASF. The amounts and terms of additional prepayment installments, if any, are subject to further negotiation between us and BASF.

As of December 31, 2020, we have applied approximately \$0.2 million of credits against amounts invoiced and a substantial amount of the prepayments remain outstanding. Although BASF has placed orders for products under the supply agreement, there can be no assurance that BASF will ever be a significant customer for our products or that we deliver product quantities that would significantly reduce the prepayments outstanding by dates that which BASF has right to request repayment. Furthermore, there can be no assurance that we or BASF will be able to perform under the supply agreement or the joint development agreement or to achieve our or its respective goals with respect to the supply agreement, the joint development agreement or the broader collaboration between us and BASF. In addition, our grant of a security interest to BASF may make it more difficult for us to pledge our assets to secure other obligations, including to potential lenders, and as a result may impede our ability to incur additional indebtedness in the future.

In the event that we are unable to develop products that meet market needs or maintain our relationship with BASF, we may be required to find less prominent partners or operate without any partner at all in the building materials market and we may be less able or unable to successfully penetrate that market. As a result of any of the above, we may lessen or lose our ability to grow our business in the building materials market which could adversely affect our business, financial condition and results of operations, including impairing our profitability.

Failure by us to develop, maintain and strengthen strategic relationships with industry leaders to commercialize our products in the electric vehicle market may adversely affect our results of operations and our ability to grow our business.

Our business strategy requires us to align the design and performance attributes of our products and technologies to the evolving needs of the market. To facilitate this process, we have sought out partnerships and relationships with industry leaders in order to assist in the development and commercialization of our products. We face competition from other manufacturers of insulation, battery materials and similar products in seeking out and entering into such partnerships and relationships with industry leaders in our target markets and we may therefore not be successful in establishing strategic relationships in those markets.

In the electric vehicle market, we are seeking to engage with industry leaders to assist in the optimization of our proprietary and patented carbon aerogels to improve the performance and cost of lithium-ion batteries. We have entered into evaluation agreement with SKC Co., Ltd. to initially explore the potential use of Aspen's silicon-rich carbon aerogel materials in the anode of lithium-ion batteries. We are also exploring various silicon materials for use with our solutions, including materials from a subsidiary of Evonik Industries AG. With the support of such third parties, we are seeking to focus our technical development and accelerate the potential commercialization of these carbon aerogel anode materials in the electric vehicle market. In addition, we are exploring with several battery and electric vehicle manufacturers to develop a highly engineered silica aerogel blanket for potential use in lithium-ion battery packs to manage the thermal runaway of the battery systems.

Unlike the other markets for which we have previously developed thermal solutions, electric vehicle market may be more demanding, technically, financially and in other ways. Additionally, the automotive industry may be more risk averse, may have longer product development and testing cycles or otherwise require resources which we cannot muster in a timely manner to successfully develop and market products and solutions. Furthermore, as we develop an anode active material for the electric vehicles market, we will be required to rely on industry partners in evaluating our materials in their respective anodes in combination with matching cathodes to produce cost effective and compelling cells for next generation electric vehicles. We may not be able to find the right partners to achieve our objectives or our interest and our partners' interest may not be well aligned.

We will continue to seek to engage with additional battery material and electric vehicle manufacturers to realize the full potential of our aerogel technology platform within the electric vehicle market. In the event that we are unable to engage with additional industry leaders or to develop products that meet market needs, we may be less able or unable to successfully penetrate that market. As a result, we may lessen or lose our ability to grow our business in the electric vehicle market which could adversely affect our business, financial condition and results of operations, including impairing our profitability.

We have entered into and may enter into future agreements that may limit our ability to broadly market our products or could involve future obligations, which could make it more difficult for us to commercialize certain of our products and negatively affect our business and results of operations.

We have a joint development agreement with BASF SE to develop products in the building materials market. In order to develop and commercialize our products, we may enter into additional joint development agreements or commercial arrangements. We cannot be certain that any products will be successfully developed under any such agreement or, even if developed, that they will be successfully produced or commercialized. These agreements may contain exclusivity, ownership of intellectual property and other terms that may limit our ability to commercialize any products or technology developed in connection with such agreements, including in ways that we do not envision at the time of entering into the agreement. In addition, these agreements may not obligate either party to make any purchases and may contain technical specifications that must be achieved to the satisfaction of our partner, which we cannot be certain we will be able to achieve. If our ability to commercialize products or technology developed in connection with these agreements is limited or if we fail to achieve the technical specifications that may be required, then our business, financial condition and results of operations could be materially adversely affected.

We may not be able to successfully develop and introduce new products in a timely manner at competitive prices, which would limit our ability to grow and maintain our competitive position and could adversely affect our financial conditions, results of operations and cash flow.

Our growth depends, primarily, on continued increase in the sales of existing products, including by improving the performance of existing products, as well as the successful development and introduction of new products, including new products for applications within the building materials and electric vehicle markets, which face the uncertainty of customer acceptance and reaction from competitors. New product development requires considerable resources and attention that may shift our focus from and may disrupt our current operations, given that we have fewer resources than many of our competitors. We may not be able to sustainably manufacture new products with attractive margins and we may experience higher production inefficiencies than expected. Any delay in the development or launch of a new product could result in our not being the first to market, which could compromise our competitive position. Even if we manage to develop and introduce new products, such products may not address market needs or

otherwise compete with third party products. Even if our new products are adopted by the market, we may not achieve the growth in revenue that we expect from such new products and our investment in these efforts may not be proportional to our expected or actual revenue growth. If we are unable to develop and introduce new products in a cost-effective manner or otherwise manage effectively the operations related to new products, our results of operations and financial condition could be adversely impacted.

If we do not continue to develop and maintain distribution channels for our products and to meet our customers' demand for our products, our results of operations could be adversely affected.

For a significant portion of our revenues, we rely on sales to distributors who then sell our products to end-users in our target markets. Our success depends, in part, on our maintaining satisfactory relationships with these distributors and develop new relationships in new geographies. Our distributors require us to meet expectations of delivery, quality and pricing of our products, at both the distribution channel level and at the level of the end-user of our products. If we fail to meet expected standards, our revenues would decline and this could materially adversely affect our business, results of operations and financial condition. In addition, we have been unable at times to produce sufficient amounts of our products to meet demand from our distributors and customers and we may not be able to avoid capacity constraints in the future if demand exceeds our expectations or we fail to expand the capacity of our existing East Providence, Rhode Island manufacturing facility in a timely manner. If we are unable to deliver our products within such short timeframes, we may be at risk of losing direct or end-use customers. Accordingly, shortfalls in sales could materially adversely affect our business and results of operations.

The qualification process for our products can be lengthy and unpredictable, potentially delaying adoption of our products and causing us to incur significant expense potentially without recovery.

Qualification of our products by many of our direct and end-use customers can be lengthy and unpredictable and many of these direct and end-use customers have extended budgeting and procurement processes. This extended sales process requires the dedication of significant time by our personnel and our use of significant financial resources, with no certainty of success or recovery of our related expenses. Furthermore, even after an extensive qualification process, our products may fail to meet the standards sought by our end-use customers and may not be qualified for use by such end-use customers. Additionally, our continued process improvements and cost-reduction efforts may require us or the end-users to re-qualify our products. Failure to qualify or re-qualify our products may result in us losing such companies as end-users of our products, which would cause a decrease in our revenue growth rate either of which could materially adversely affect our business and results of operations.

Our revenue may fluctuate, which may result in a high degree of variability in our results of operations and make it difficult for us to plan based on our future outlook and to forecast our future performance.

Our revenue may fluctuate from period to period due to a wide variety of factors. Since we rely on sales to a limited number of direct customers/distributors and end-use customers, changes in demand from one or more direct customers or end-users can significantly impact our revenue from period to period. In addition, the sales cycles for our products, including their qualification for use, are long and can result in unpredictability in our revenues. We expect to have an increasing percentage of our products sold for use in capital projects, which orders tend to be larger and more sporadic, that will further increase this unpredictability and the difficulty for us in forecasting quarterly or annual performance. Because of these factors, we have a limited basis on which to predict our quarterly revenue. Our profitability from period-to-period may also vary due to the mix of products that we sell in different periods. These factors may result in a high degree of variability in our results of operations and will make it difficult for us to accurately evaluate and forecast quarterly or annual performance and to plan based on our future outlook.

The results of our operations could be materially adversely affected if our operating expenses incurred do not correspond with the timing of our revenues.

Most of our operating expenses, such as manufacturing facility expenses, employee compensation and research expenses, are either relatively fixed in the short-term or incurred in advance of sales. In addition, our spending levels are based in part on our expectations regarding future revenues. As a result, if revenues for a particular quarter are below expectations, we may not be able to proportionately reduce operating expenses for that quarter. Our reliance on sales to a limited number of direct customers/distributors and end-use customers, the length of our sales cycles and the potentially increasing percentage of our products sold for use in capital projects each can cause sporadic demand for our products which would limit our ability to predict future sales. This limitation could result in our being unable to reduce spending quickly enough to compensate for reductions in sales and could therefore adversely affect our results of operations for any particular operating period.

We are exposed to the credit risk of some of our direct customers, including distributors, contractors and OEMs, which subjects us to the risk of non-payment for our products.

We distribute our products through a network of distributors, contractors and OEMs, some of which may not be well-capitalized and may be of a lower credit quality. This direct customer network subjects us to the risk of non-payment for our products. In addition, we operate in a number of countries characterized by intermittent governmental, market and financial crises. During 2018, we established a reserve for uncollectible accounts receivable from a Brazilian contractor for \$2.8 million related to a single project and wrote off another \$0.1 million in accounts receivable due to non-payment of amounts due by a European customer. During 2019, we determined that collection of the remaining unpaid accounts receivable from the Brazilian contractor of \$2.6 million was unlikely and recorded a write-off of the accounts receivable and the corresponding allowance for doubtful accounts. During 2020, we established an estimated reserve for uncollectible accounts receivable for \$0.3 million. In addition, during periods of economic downturn in the global economy, our exposure to credit risks from our direct customers may increase, and our efforts to monitor and mitigate the associated risks may not be effective. In the event of additional non-payments by one or more of our direct customers, our business, financial condition and results of operations could be materially adversely affected.

If we fail to achieve the increase in production capacity that our long-term growth requires in a timely manner, or at all, our growth may be hindered and our business or results of operations may be materially adversely affected.

If, for any reason, including our inability to obtain financing, our planned expansion of capacity in our existing East Providence, Rhode Island facility should fail to be completed in a timely manner, or at all, or any of the production lines in our existing or future manufacturing facilities do not operate according to our expectations, sales and or profitability may be impeded, our growth may be hindered and our business or results of operations may be materially adversely affected.

Many factors could delay, impede or prevent the expansion of our existing manufacturing facility, or construction and operation of future, potential manufacturing facilities, or cause us to reduce the scale or scope of the expansion projects, including:

- our inability to obtain financing on favorable terms, or at all;
- design, engineering and construction difficulties or delays;
- our failure or delay in obtaining necessary legal, regulatory and other approvals and permits;
- interruptions in the supply of the necessary equipment, or construction materials or labor or an increase in their respective prices;
- opposition of local interests; and
- natural disasters, accidents, political unrest or unforeseen events, man-made or otherwise.

Many factors could prevent our existing and future, potential manufacturing facilities from producing at expected, projected or targeted nameplate capacities or could cause us to reduce the scale or scope of future capacity expansions or facilities, including:

- design and engineering failures;
- inability to retain, manage and train a skilled workforce;
- the challenges of operating technically advanced or higher volume equipment than currently employed at our existing facility in East Providence, Rhode Island;
- improper operation of the manufacturing equipment;
- decreases in our manufacturing yields due to the inefficient use of the materials needed to make our products in our manufacturing process;
- the availability of raw materials at reasonable costs to support the levels of production that we anticipate at these facilities;
- strikes or labor disputes; and
- damage to the manufacturing equipment due to design and engineering flaws, construction difficulties or operator error.

Any such capacity expansion will place a significant strain on our senior management team and our financial and other resources. The costs associated with and the resources necessary for our capacity expansion plans could exceed our expectations and result in a materially adverse impact on our business, results of operations, financial condition and cash flows.

If we are unable to complete the projects as contemplated, the costs incurred in connection with such projects may not be recoverable. For example, during 2013, we redesigned and reduced the planned scale of the third production line in our East

Providence, Rhode Island facility. We recorded an associated \$3.4 million impairment charge during 2013 to write off certain construction in progress assets. In addition, during 2018, we determined that our engineering plans, designs and drawings for a second manufacturing facility in Statesboro, Georgia would not be used due principally to our decision to significantly delay construction of the facility and intervening technical developments. Accordingly, we recorded an impairment charge of \$7.4 million in 2018 on pre-construction and related costs for the Statesboro facility.

A redesign of, change in scale of, or failure to initiate and complete the construction of potential manufacturing facilities and other similar impairments of our assets in the future could result in a materially adverse impact on our business, results of operations, and financial condition.

Furthermore, manufacturing of our silicon-rich carbon aerogel anode materials at required scales at competing cost may be challenging. Our silicon-rich anode materials are designed replace graphite partially or completely in current graphitic anodes. Graphite prices are at least an order of magnitude lower than projected cost of our silicon-rich materials. In order to participate in the silicon-rich anode market with any meaningful market share, we need to rapidly scale up our processes to make hundreds of tons per year. Though we have had prior experience successfully scaling up silica-based aerogels, carbon aerogels and silicon-carbon composite aerogels may present their own unique technical and supply chain challenges that may be difficult to overcome in short order, which may adversely impact our business.

If the expected growth in the demand for our products does not follow after each of our planned capacity expansions, then our business will be materially adversely affected.

Our long-term growth plan requires that we continue to increase our production capacity. As we pursue our capacity expansion plans, we will incur significant capital expenditures and increased levels of manufacturing expenses in anticipation of expected growth in demand for our products. In particular, we expect that these substantial additional expenditures will be made by us significantly in advance of the existence of the level of demand that would ensure the most efficient use of our planned new capacity. As a result, if the expected growth in demand for our products fails to materialize within a reasonable amount of time following each of our planned capacity expansions, whether because of low oil and gas prices, the loss of a significant customer, the failure to develop new markets or for any other reason, then we would suffer decreased levels of cash flow and our financial condition and results of operations would be adversely affected.

Growth has placed significant demands on our management systems and our infrastructure. If we fail to manage our long-term growth effectively, we may be unable to execute our business plan, address competitive challenges and meet applicable product specifications and technical and delivery requirements.

We may be unable to manage our growth. To manage our anticipated future growth, we must continue to:

- improve and expand our manufacturing, sales and marketing, and engineering organizations;
- enhance our research and development capabilities and resources;
- improve regulatory compliance, financial control and reporting systems;
- expand our manufacturing and distribution facilities and capacity; and
- recruit, train and retain additional qualified personnel to enhance our managerial capabilities.

All of these measures will require significant expenditures and will demand the attention of management. At certain points in the past, significant growth in demand for our products has put our management and operating systems under strain. In addition, the physical expansion of our operations may lead to significant costs and may divert our management and business development resources. Furthermore, we compete for personnel and advisors with other companies and other organizations, many of which are larger and have greater name recognition and financial and other resources than we do. Due to our limited resources, we may not be able to effectively manage the expansion of our operations or adequately recruit, train and retain qualified personnel. Any inability to manage growth could result in a loss of existing customers and revenues, delays in the execution of our business plans, and disruption of our operations. If we fail to achieve the necessary level of efficiency in our organization as it grows, it could have a material adverse impact on our business, results of operations and financial conditions.

We allocate our manufacturing operations, sales and marketing, research and development, general and administrative and financial resources based on our business plan, which includes assumptions about current and future orders and revenues from customers. However, the factors involved in such projections are uncertain. If our assumptions regarding these factors prove to be incorrect or if competing products gain further market share, then actual demand for our aerogel products could be significantly less than the demand we anticipate and we may not be able to grow our revenue or achieve profitability.

A substantial portion of our revenue comes from sales in foreign countries and we may expand our operations outside of the United States, which subjects us to increased economic, trade, foreign exchange, operational and political risks that could materially adversely impact our business, financial conditions and results of operations and also increase our costs and make it difficult for us to operate profitably.

A substantial portion of our recent sales are to destinations outside the United States, including Thailand, Norway, Canada, Great Britain, Singapore, Korea, Hong Kong, Australia, Egypt, and Taiwan. Total revenue generated from outside of the United States, based on our shipment destination, amounted to \$55.5 million or 55% of total revenue, \$81.0 million or 58% of total revenue and \$62.6 million or 60% of total revenue, for the years ended December 31, 2020, 2019 and 2018, respectively. As a result, we are subject to a number of risks, including, but not limited to:

- the effect of applicable U.S. and foreign tax structures, including tax rates that may be higher than tax rates in the United States or taxes that may be duplicative of those imposed in the United States;
- trade relations among the United States and those foreign countries in which our customers and suppliers have operations, including protectionist
 measures such as tariffs and import or export licensing requirements, whether imposed by the United States or such foreign countries, in particular the
 strained trade relations between United States and China since 2018;
- general economic and political conditions in each country, which may interfere with, among other things, our supply chain, our customers and all of our activities in a particular location;
- difficulty in the enforcement of contractual obligations in non-U.S. jurisdictions and the collection of accounts receivable from foreign accounts;
- different regulatory regimes in the various countries in which we operate or sell our products;
- inadequate intellectual property protection in foreign countries;
- the difficulties and increased expense in complying with multiple and potentially conflicting domestic and foreign laws, regulations, product approvals and trade standards, including the U.S. Foreign Corrupt Practices Act, or FCPA, and similar anti-bribery laws in non-U.S. jurisdictions, as well as the rules and regulations of the U.S. Department of Treasury's Office of Foreign Assets Control, or OFAC, and similar sanctions laws;
- foreign currency exchange controls, restrictions and fluctuations, which could result in reduced revenue and increased operating expense;
- transportation delays or interruptions;
- labor rules and collective bargaining arrangements in foreign jurisdictions;
- difficulty in staffing and managing (including ensuring compliance with internal policies and controls) geographically widespread operations; and
- terrorist activity and political unrest, particularly given the use of our products at energy facilities.

In addition, sales of our products are generally conducted in U.S. dollars and we also bid for foreign projects in U.S. dollars. The strengthening of the U.S. dollar against the local currencies in the countries into which we sell our products may result in our products becoming more expensive relative to competing insulation products priced in local currencies. If the U.S. dollar strengthens, our sales into foreign countries with relatively weaker currencies may be adversely impacted and we may be less competitive in bidding for projects in those markets.

Our success will depend in large part on our ability to manage the effects of continued global political and economic uncertainty, especially in our international markets.

Because of our significant international operations, we could be materially adversely affected by violations of the U.S. FCPA and similar anti-corruption, anti-bribery and anti-kickback laws.

We operate on a global basis, with 56% of our product sales in 2020 made to destinations outside the United States, including Canada, Mexico, Europe, Asia, South America and the Middle East. Our business operations and sales in countries outside the United States are subject to anti-corruption, anti-bribery and anti-kickback laws and regulations, including restrictions imposed by the FCPA, as well as the United Kingdom Bribery Act of 2010, or UK Bribery Act. The FCPA, UK Bribery Act, and similar anti-corruption, anti-bribery and anti-kickback laws in other jurisdictions generally prohibit companies, their intermediaries and their agents from making improper payments to government officials or any other persons for the purpose of obtaining or retaining business. We operate

and sell our products in many parts of the world that have experienced governmental corruption to some degree and, in certain circumstances, strict compliance with anti-corruption, anti-bribery and anti-kickback laws may conflict with local customs and practices. We train our employees concerning anti-corruption, anti-bribery and anti-kickback laws and have policies in place that prohibit employees from making improper payments. We continue to implement internal controls and procedures designed to ensure that we comply with anti-corruption, anti-bribery and anti-kickback laws, rules and regulations and mitigate and protect against corruption risks. We cannot provide assurance that our internal controls and procedures will protect us from reckless, criminal or other acts committed by our employees or third-parties with whom we work. If we are found to be liable for violations of the FCPA or similar anti-corruption, anti-bribery and anti-kickback laws in international jurisdictions, either due to our own acts or out of inadvertence, or due to the acts or inadvertence of others, we could suffer criminal or civil fines or penalties or other repercussions, including reputational harm, which could have a material adverse effect on our business, results of operations and financial condition.

A failure to comply with export control or economic sanctions laws and regulations could have a material adverse impact on our business, results of operations or financial condition. We may be unable to ensure that our distributors comply with applicable sanctions and export control laws.

We operate on a global basis, with 56% of our product sales in 2020 made to destinations outside the United States, including Canada, Mexico, Europe, Asia, South America and the Middle East. We face several risks inherent in conducting business internationally, including compliance with applicable economic sanctions laws and regulations, such as laws and regulations administered by OFAC, the United States Department of State and the United States Department of Commerce. We must also comply with all applicable export control laws and regulations of the United States and other countries. Violations of these laws or regulations could result in significant additional sanctions including criminal or civil fines or penalties, more onerous compliance requirements, more extensive debarments from export privileges or loss of authorizations needed to conduct aspects of our international business.

In certain countries, we may engage third party agents or intermediaries, such as customs agents, to act on our behalf and if these third-party agents or intermediaries violate applicable laws, their actions may result in criminal or civil fines or penalties or other sanctions being assessed against us. We take certain measures designed to ensure our compliance with U.S. export and economic sanctions law and we believe that we have never sold our products to Iran, Cuba, Sudan or Syria through third party agents or intermediaries or made any effort to attract business from any of these countries. However, it is possible that some of our products were sold or will be sold to distributors or other parties that, without our knowledge or consent, re-exported or will re-export such products to these countries. Although none of our non-U.S. distributors are located in, or to our knowledge, conduct business with Iran, Cuba, Sudan or Syria, we may not be successful in ensuring compliance with limitations or restrictions on business with these or other countries subject to economic sanctions. There can be no assurance that we will be in compliance with export control or economic sanctions laws and regulations in the future.

Any such violation could result in significant criminal or civil fines, penalties or other sanctions and repercussions, including reputational harm that could have a material adverse impact on our business, results of operations or financial condition.

We rely on sales to a limited number of direct customers, including distributors, contractors, OEMs, partners and end-use customers for the substantial majority of our revenue, and the loss of one or more significant direct customers or several of our smaller direct customers could materially harm our business. In addition, we understand from our direct customers that a substantial majority of their sales of our products are to a small number of end-use customers and the loss of one or more significant end-use customers or several of our smaller end-use customers could materially harm our business.

A substantial majority of our revenue is generated from sales to a limited number of direct customers, including distributors, contractors, OEMs, partners and end-use customers. For the years ended December 31, 2020, 2019 and 2018, total revenue from our top ten direct customers represented 66%, 68% and 63% of our revenues, respectively. Distribution International, Inc. and SPCC Joint Venture represented 21% and 15% of our total revenue in 2020, respectively; Distribution International, Inc. and SPCC Joint Venture represented 20% and 13% of our total revenue in 2019; Distribution International, Inc. represented 20% of our total revenue in 2018. Although the composition of our significant distributors, contractors, OEMs, partners and end-use customers will vary from period to period, we expect that most of our revenues will continue, for the foreseeable future, to come from sales to a relatively small number of direct customers. In addition, we understand from our direct customers that a substantial majority of their sales of our products are to a small number of end-use customers.

Our direct customer concentration also creates accounts receivable concentrations and related risks. As of December 31, 2020, SPCC Joint Venture accounted for 26% of our accounts receivable.

The substantial majority of our sales to distributors are transacted on a purchase order basis. The contracts we enter into with our direct customers generally do not include long-term commitments or minimum volumes that ensure future sales of our products. In addition, we understand that our direct customers' contracts with end-use customers also generally do not include such commitments or minimums. Consequently, our results of operations may fluctuate significantly from period-to-period based on the actions of one or more significant direct customers or end-use customers.

A direct customer may take actions that affect us for reasons that we cannot anticipate or control, such as reasons related to an end-use customer's financial condition, contractual arrangements with end-use customers, changes in business strategy or operations, the introduction of alternative competing products, or as the result of the perceived quality or cost-effectiveness of our products. Our agreements with these direct customers may be cancelled if we fail to meet certain product specifications or materially breach the agreement or for other reasons outside of our control. In addition, our direct customers may seek to renegotiate the terms of current agreements upon maturity or renewal. The loss of, or a reduction in sales or anticipated sales to, one or more of our significant direct customers or end-use customers or several of our smaller direct customers or end-use customers could have a material adverse effect on our business, financial condition and results of operations.

If we are unable to maintain our technological advantage over our competitors, our business may be materially adversely affected.

We research, develop, manufacture and sell high-performance aerogel insulation products. Rapid and ongoing changes in technology and product standards could quickly render our products less competitive, or even obsolete, particularly if we fail to continue to improve the performance of our insulation products. We are currently developing new applications for our existing products as well as new aerogel technologies; however, our efforts may not be successful and new applications or technologies may not be commercially useful. Other companies that are seeking to enhance traditional insulation materials have recently introduced or are developing other emerging insulation technologies. These competitors are engaged in significant development work on these various insulation products. Competing technologies that outperform our insulation in one or more performance attributes could be developed and successfully introduced.

We are also aware of certain companies, including Armacell International S.A., Guangdong Alison Hi-Tech Co, Ltd., Nano Tech Co, Ltd, and a variety of other companies based in Asia that have developed or are developing and/or marketing products using aerogel technology similar to our technology and these or other companies have introduced or could introduce aerogel products that compete directly with our products and could in the future outperform our products in one or more performance attributes, could be offered to our customers as a cheaper alternative to our products or may result in increased pricing pressure on our products. As a result of increasing competitive activity by other companies in the aerogel insulation market, both now and in the future, we may not be able to sustain our competitive position in our target markets. Any degradation in our competitive position could have a material adverse effect on our business, financial condition and results of operations.

Furthermore, certain technological advancements may render our products obsolete. In particular, the future direction of electric vehicle battery packs will be a commercially reasonable balance between the need for higher energy densities and the need for better safety outcomes. A rapid progress towards certain technologies such as solid electrolytes, safer electrode active materials (such as LFP cathodes) may provide a better balance of energy density and safety thus rendering our premium thermal barriers obsolete. A thermal barrier that nominally provides thermal resistance may be sufficient to provide the right balance.

Negative perceptions regarding the safety, quality or other attributes of our products or a failure or a perceived failure of our products could have a material adverse effect on our results of operations and could make us unable to continue our business.

Given the history of asbestos as an insulation material, we believe that there is an elevated level of attention towards perceived health and safety risks in the insulation industry. As a consequence, it is essential to our existing business and to our future growth that our products are considered safe. Even modest perceptions by existing or potential distributors, contractors or end-use customers in our target markets that our products are not safe could have a critical impact on our ability to sell our products and to continue as a business. Further, our competitors have in the past, and may in the future, seek to create or perpetuate such perceptions. There is risk of an actual or perceived failure of our products or other negative perceptions regarding our products, such as perceived health hazards. For example, dust is produced by our products during their installation and use, which increases the likelihood of the perception of a hazard. Another example is the potential in very high temperature applications for material failure. Like most insulation products, our Pyrogel XT and XTE products will normally go through a controlled burn-in process immediately after exposure to high temperatures. If installed improperly, the burn-in may proceed too rapidly and the material may become damaged. In addition, the thermal performance of our materials may degrade over time due to a variety of operational or environmental conditions. We take steps to educate our distributors, contractors, OEMs and end-use customers on the nature of our products and the proper installation and operating procedures in order to mitigate these risks. Such an event, or the perception of such an event, could quickly result in our direct and end-use customers replacing our products with traditional insulation materials which could have a material adverse effect on our results of operations.

Our activities and operations are subject to numerous health and safety laws and regulations. If we violate such regulations, we could face penalties and fines or be required to curtail or cease operations.

We are subject to numerous health and safety laws and regulations in each of the jurisdictions in which we operate. These health and safety laws and regulations apply to us including with regard to hazardous substances that we use in our manufacturing process and that certain of our products contain. These substances include titanium dioxide, iron oxide, ethanol and carbon black, each of which has been determined, in certain forms, with certain contaminants and at certain levels, to be hazardous, possibly carcinogenic or otherwise harmful to humans. We may also consider and adopt the use of other hazardous substances or substances potentially containing hazardous contaminants, with similar or higher risks in connection with new products or modifications to our current products and related manufacturing.

Our processes also require the use of other regulated substances in raw material delivery and manufacturing, including among others, ethanol. Applicable laws and regulations require us to obtain and maintain permits and approvals and implement health and safety programs and procedures to control risks associated with our operations. Compliance with those laws and regulations can require us to incur substantial costs. Moreover, if our compliance programs are not successful, we could be subject to penalties or to revocation of our permits, which may require us to curtail or cease operations of the affected facilities. In particular, the construction of future, potential facilities will require us to obtain and maintain new permits from various regulatory authorities and if the issuance of such permits is delayed or denied, it would slow or potentially prevent the expansion of our manufacturing capacity. Violations of laws, regulations and permit requirements may also result in criminal sanctions, injunctions and the denial or revocation of our various permits.

While we use hazardous substances, including titanium dioxide, carbon black and similar chemicals, in forms and at levels that are subject to current rules and regulations, such rules and regulations may become more stringent such that we are required to modify our manufacturing process and such that our customers' use of our products may be impacted. Regulatory changes contemplated in several countries, particularly in Europe, may substantially increase these risks. Changes in the products or manufacturing processes may require the customers to perform an extensive re-qualification process, which our customers may not want to undertake for various reasons, resulting in the customer switching to competing products. In addition, changes in our production or manufacturing process may result in uses above currently permitted levels. Such uses or changes in rules or regulations could materially adversely affect our business, financial condition and results of operations.

Health and safety laws, regulations and permit requirements may become more stringent or otherwise change. Any such changes could require us to incur materially higher costs than at present. Our costs of complying with current and future health and safety laws, regulations and permit requirements, and any liabilities, fines or other sanctions resulting from violations of them, could adversely affect our business, financial condition and results of operations.

We may face certain product liability or warranty claims on our products, including from improper installation of our products by third parties. As a consequence, we could lose existing and future business and our ability to develop, market and sell our insulation could be harmed.

The design, development, production and sale of our products involve an inherent risk of product liability claims and associated adverse publicity. We seek to lower our manufacturing costs, while maintaining appropriate performance characteristics, and to improve the per square foot costs of our silica aerogel blankets by optimizing our formulations to reduce material costs. If our products do not function as represented as a result of such changes in formulations, we may face warranty claims on our products. In addition, we may be named directly in product liability suits relating to our products, even for defects resulting from errors of our distributors, contractors, OEMs, partners or end-use customers. These claims could be brought by various parties, including distributors, contactors, OEMs, partners and other direct end-use customers who are purchasing products directly from us, or end-use customers who purchase our products from our distributors. We could also be named as coparties in product liability suits that are brought against the distributors, contractors, OEMs, partners and end-use customers. Our products are often installed in our end-use customers' complex and capital intensive facilities in inherently hazardous or dangerous environments, including in the energy, petrochemical and power generation industries, where the potential liability from risk of loss could be substantial. The failure of our products to perform to customer expectations, whether or not because of improper installation, could give rise to warranty claims against us. We take steps to educate our distributors, contractors, OEMs, partners and end-use customers about the proper installation procedures to mitigate the risk of an uncontrolled burn-in for very high temperature applications of Pyrogel XT and XTE. However, installation of our products is handled by third parties over whom we have no control and errors or defects in their installation may also give rise to claims against us, diminish our brand or divert our resources

A material product liability claim may seriously harm our results of operations, as well as damage our customer relationships and reputation. Although we carry general liability insurance, our current insurance coverage could be insufficient to protect us from all liability that may be imposed under these types of claims. In addition, our distributors, contractors, OEMs, partners and end-use customers may not have adequate insurance to cover against potential claims. If claims or losses exceed our liability insurance coverage, we may go out of business. In addition, insurance coverage is expensive, may be difficult to obtain and may not be available in the future on acceptable terms or at all. A significant increase in the cost of insurance coverage could adversely affect our business, financial condition and results of operations.

We may incur significant costs complying with environmental, health and safety laws and related claims, and failure to comply with these laws and regulations could expose us to significant liabilities, which could materially adversely affect our results of operations.

Costs of compliance with regional, national, state and local existing and future environmental, health and safety laws and regulations could adversely affect our cash flow and results of operations. We are required to comply with numerous environmental laws and regulations and to obtain numerous governmental permits in order to operate our facilities and in connection with the design, development, manufacture and transport of our products and the storage, use, handling and disposal of hazardous substances, including environmental, health and safety laws, regulations and permits governing air emissions or water usage and disposal. We may incur significant additional costs to comply with these requirements, which requirements are becoming stringent in a progressive manner. If we fail to comply with these current and new requirements, we could be subject to civil or criminal liability, damages and fines, require substantial capital investment to remedy non-compliance, and our operations could be curtailed, suspended or shutdown. In addition, certain foreign laws and regulations may affect our ability to export products outside of the United States. Existing environmental, health and safety laws and regulations could occur. These factors may materially increase the amount we must invest to bring our processes into compliance and impose additional expense on our operations.

Among the changes to environmental laws and regulations that could occur is the adoption of regulatory frameworks to reduce greenhouse gas emissions, which a number of countries, particularly in the European Union, have adopted, or are considering adopting, including the 2015 Paris Agreement on climate change. These include adoption of cap and trade regimes, carbon taxes, restrictive permitting, increased efficiency standards, and incentives or mandates for renewable energy, any of which could increase the costs of manufacturing our products and increase our compliance costs, and/or reduce demand for our products from our customers in the energy industry, all of which could materially adversely affect our business and results of operations.

In addition, private lawsuits, including claims for remediation of contamination, personal injury or property damage, or actions by regional, national, state and local regulatory agencies, including enforcement or cost-recovery actions, may materially increase our costs. Certain environmental laws make us potentially liable on a joint and several basis for the remediation of contamination at or emanating from properties or facilities that we currently or formerly owned or operated or properties to which we arranged for the disposal of hazardous substances. Such liability may require us to pay more than our fair share and could require us to address contamination caused by others. For example, the site of our East Providence facility contains certain levels of contamination caused by prior third-party activities on and near the site. Such contamination remains in place under a state-approved deed restriction, and we are required to comply with such deed restriction and the accompanying soil management plan. In general, the deed restriction prohibits the residential use of the property and the use of groundwater as potable water, and requires the maintenance of engineering controls and annual inspections to help prevent exposure to contaminated soils. The soil management plan requires us to notify the state environmental agency with respect to any soil excavation, stockpiling, sampling and off-site disposal of excavated soil. Although we have not had to make material expenditures to satisfy these requirements to date, in the future, we may incur additional costs to comply with these requirements and failure to do so could disrupt the operation of our facility or could subject us to liability for environmental remediation. We may incur liability relating to the remediation of contamination, including contamination we did not cause. Furthermore, ethanol, one of the materials that we handle in large quantities in our manufacturing process is subject to additional laws and regulations including those administered by the U.S. Alcohol and Tobacco Tax and Trade Bureau. While we seek to comply with the stringent requirements of these laws and regulations, these laws and regulations are complex and are subject to interpretation. Any changes in these laws or regulations or any interpretation thereof, or changes in our manufacturing processes may require us to request changes to our existing permits or obtain new permits. Any requests to change our existing permits or obtain new permits may be delayed or denied and may require us to modify our manufacturing processes, which could be costly and time consuming and could adversely affect our business and results of operations.

We may not be able to obtain or maintain, from time to time, all required environmental regulatory approvals. A delay in obtaining any required environmental regulatory approvals or failure to obtain and comply with them could materially adversely affect our business and results of operations.

Breakdowns, security breaches, loss of data and other disruptions of our information technology systems could compromise sensitive information related to our business, prevent us from accessing critical information and expose us to liability, which would cause our business and reputation to suffer.

In the ordinary course of our business, we collect and store sensitive data, including intellectual property, our proprietary business information and that of our suppliers, customers and business partners, and personally identifiable information about our employees. We manage and maintain our applications and data utilizing on-site and off-site systems. These applications and data encompass a wide variety of business critical information including research and development information, commercial information and business and financial information.

The secure processing, storage, maintenance and transmission of this critical information is vital to our operations and business strategy, and we devote resources to protecting such information. Although we take measures to protect sensitive information from unauthorized access or disclosure, our information technology and infrastructure may be vulnerable to breakdowns, attacks by hackers, viruses, breaches or interruptions due to employee error, malfeasance or other disruptions, or lapses in compliance with privacy and security mandates. Any such virus, breakdown, attack, breach or interruption could compromise our networks and the information stored there could be accessed by unauthorized parties, publicly disclosed, lost or stolen. We have measures in place that are designed to detect and respond to such security incidents and breaches of privacy and security mandates, but there can be no assurance that our efforts will prevent such breakdowns or breaches in our systems.

Recently, a specific kind of cyber threat, targeted mostly at small and medium-sized enterprises involves the so called "ransomware" attacks in which a hostile actor breaches the security of the information network and locks down the network to prohibit access to the system from its intended users. The hostile actor demands monetary payments in exchange for releasing the network to allow its normal operation. We may not be able to pay such actors on financial or legal grounds and even if such payments are made, there is no guarantee such actors would follow through with the promise to release the network. Any such breach, access, disclosure or other loss of information or access could result in legal claims or proceedings, liability under laws that protect the privacy of personal information or other laws, government enforcement actions and regulatory penalties. Unauthorized access, loss or dissemination could also disrupt our operations, customer support services, research and development activities, capture of company financial informati

Our contracts with U.S. government agencies may subject us to audits, criminal penalties, sanctions and other expenses and fines.

We perform contract research services for U.S. government agencies and our products are sold to customers that may incorporate them into government projects. U.S. government agencies, including the Defense Contract Audit Agency and the Department of Labor, routinely audit government contractors. These agencies review a contractor's compliance with contract terms and conditions, performance under its contracts, cost structure and compliance with applicable laws, regulations and standards. The U.S. government also may review the adequacy of a contractor's systems and policies, including a contractor's purchasing, property, estimating, billing, accounting, compensation and management information systems. Any costs found to be overcharged or improperly allocated to a specific contract or any amounts improperly billed or charged for products or services will be subject to reimbursement to the government. As a government contractor, we are required to disclose to the U.S. government credible evidence of certain violations of law and contract overpayments. If we are found to have participated in improper or illegal activities, we may be subject to civil and criminal penalties and administrative sanctions, including termination of contracts, forfeiture of profits, suspension of payments, fines and suspension or prohibition from doing business with the U.S. government. Any negative publicity related to such contracts, regardless of the accuracy of such publicity, may adversely affect our business or reputation.

Our contracts with U.S. government agencies may not be funded by future appropriations and are subject to modification or termination at any time prior to their completion.

Our contracts with U.S. government agencies are subject to the availability of appropriated funds. The U.S. government funds our contract research work through a variety of funding programs that rely on monies appropriated by Congress. At any point, the availability of funding could change, thus reducing the opportunities for continued revenues to us from government contract work. Revenue from contracts with U.S. government agencies constituted less than 1% of our total revenue in 2020, and 2% in 2019 and 2018.

In addition, under our contracts, the U.S. government generally has the right not to exercise options to extend or expand our contracts and may modify, curtail or terminate the contracts at its convenience. Our government customers may not renew our existing contracts after the conclusion of their terms and we may not be able to enter into new contracts with U.S. government agencies. Any decision by the U.S. government not to exercise contract options or to modify, curtail or terminate our contracts or not to renew our contracts or enter into new contracts with us would adversely affect our revenues.

If we lose key personnel upon whom we are dependent, or if we are unable to successfully recruit and retain skilled employees, we may not be able to manage our operations and meet our strategic objectives.

Our continued success depends to a considerable degree upon the continued services of a small number of our employees with critical knowledge of our products, our manufacturing process, our intellectual property, our customers and our global operations. The loss or unavailability of any of these individuals could harm our ability to execute our business plan, maintain important business relationships and complete certain product development initiatives, which could harm our business. In the event that any of these key individuals leave their employment with us or take new employment with a competitor, our business and results of operations could be materially adversely affected. In addition, our continued success depends upon the availability, contributions, vision, skills, experience and effort of our senior management, financial, sales and marketing, engineering and production teams. We do not maintain "key person" insurance on any of our employees. We have entered into employment agreements with certain members of our senior management team, but none of these agreements guarantee the services of the individual for a specified period of time. All of the agreements with members of our senior management team provide that employment is at-will and may be terminated by the employee at any time and without notice.

The loss of the services of any of key employees might impede our operations or the achievement of our strategic and financial objectives. The loss or interruption of the service of any of these individuals or our inability to attract or retain other qualified personnel or advisors could have a material adverse effect on our business, financial condition and results of operations and could significantly reduce our ability to manage our operations and implement our strategy.

Our ability to use our net operating loss carryforwards may be subject to limitation, which could result in a higher effective tax rate and adversely affect our financial condition and results of operations.

During 2014, we performed analyses pursuant to Section 382 of the Internal Revenue Code of 1986, as amended, or the Internal Revenue Code, as well as similar state provisions, in order to determine whether any limitations might exist on the utilization of net operating losses and other tax attributes. Generally, a change of more than 50% in the ownership of a company's stock, by value, over a three-year period constitutes an ownership change for U.S. federal income tax purposes. An ownership change may limit a company's ability to use its net operating loss carryforwards attributable to the period prior to such change. Based on these analyses, we determined that it is more likely than not that an ownership change occurred on June 18, 2014 upon the closing of our IPO, resulting in an annual limitation on the use of our net operating losses and other tax attributes as of such date. As a result, our prior net operating losses were limited to \$155.2 million, including built-in gains of \$42.0 million at the date of that ownership change. The use of our net operating loss carryforwards may be restricted further in the event of any future changes in our ownership.

Our wholly-owned subsidiary, Aspen Aerogels Rhode Island, LLC, or the Borrower, applied for and received a loan under the Paycheck Protection Program of the CARES Act, or the PPP, pursuant to which there is no guarantee that a loan may be forgiven and we may be subjected to challenges, reviews, and investigations regarding qualification or certifications made in the application for the loan. In addition, the Borrower may be subject to an audit in connection with the loan and should the Borrower request that the loan be forgiven, the United States Small Business Administration, or SBA, will conduct a full audit in connection with the loan. If there is any adverse finding from the audit or if Borrower is subject to any other investigation or challenge in connection with the loan, the Borrower could be required to return the full amount of the PPP Loan plus interest, which could reduce our liquidity, and could be subject to significant fines, damages and penalties and its business could otherwise be adversely affected, whether or not there is an adverse finding. As the Borrower's parent, such events could have a material adverse effect on our business, financial condition and results of operations.

On May 1, 2020, the Borrower entered into a promissory note, or the PPP Loan Documents, to receive a loan, or the loan, pursuant to the PPP established under the CARES Act in the aggregate amount of approximately \$3.7 million, or the Loan Proceeds. Under the terms of the CARES Act, recipients of PPP loans from SBA, or PPP Loans, can elect to apply for forgiveness for all or a portion of a PPP Loan after eight weeks or 24 weeks. Such forgiveness will be determined, subject to limitations, based on the use of loan proceeds during a specified eight-week period for payroll costs and mortgage interest, for rent or utility costs and for the maintenance of employee staffing and compensation levels, although no more than 25% of the amount forgiven can be attributable to non-payroll costs. No assurance is provided that the Borrower will elect to pursue forgiveness of all or a portion of the loan or be eligible for and obtain forgiveness of all or a portion of the loan. If the Borrower elects not to pursue or is unable to qualify for or obtain forgiveness of all or a portion of the loan, our liquidity could be reduced and our business, financial condition and results of operations may be adversely affected. Pursuant to the requirements under the CARES Act, in connection with the loan, the Borrower certified that current economic uncertainty makes the loan request necessary to support the ongoing operations of the Borrower. We believe that the Borrower made such certification in a manner consistent with SBA guidance that borrowers must make the certification in good faith, taking into account their current business activity and their ability to access other sources of liquidity

sufficient to support their ongoing operations in a manner that is not significantly detrimental to the business. While we believe the Borrower's prior and future certifications were and will be well supported on the dates certified, in light of the understandings of the requirements and the assessment made on the certification date, we cannot be certain that SBA or any other governmental entity or third party will concur with the Borrower, especially in light of the press scrutiny and SBA's evolving guidance and views and the eventual extent of the impact of current economic uncertainties on Borrower's operations. Further, although the Borrower conferred with representatives of SBA prior to finalizing the loan, we cannot be certain that as subsidiary of a public company, the Borrower might not be deemed to have improperly made the required certifications, including that current economic uncertainty makes the loan request necessary to support the ongoing operations of the Borrower, taking into account the Borrower's current business activity and ability to access other sources of liquidity sufficient to support its ongoing operations in a manner that is not significantly detrimental to the business.

Subsequent to the Borrower's application for the loan, SBA issued various interpretive guidelines in connection with the PPP, including guidance on how SBA interprets certain of the certification requirements. One of the interpretations appears to be in response to various press reports that well established or well capitalized private and public companies were able to secure PPP loans that were meant for smaller companies. SBA's interpretive guidelines published on April 23, 2020 set forth that public companies with substantial market value and access to capital markets would not qualify to participate in the PPP and SBA advised any such public company to be prepared to provide the basis for the certifications upon SBA request. Subsequently, on April 28, 2020 the Secretary of the Treasury and Small Business Administrator announced that the government will conduct a full audit of all PPP loans of more than \$2.0 million for which the borrower applies for forgiveness. As the Borrower expects it will be audited or reviewed by SBA or the U.S. Department of the Treasury if it files an application for forgiveness, and, whether or not it elects to seek forgiveness of all or part of the loan, it could be subject to investigation, audit or other review by governmental agencies or claims by third parties, with respect to whether it qualified for an PPP Loan, or whether the certifications it made to obtain the loan are accurate, or other matters. There is a risk that any such audit, review, investigation or claim could result in the diversion of our management's time and attention, in the need to incur significant legal expenses and in the possibility that we will sustain reputational injuries. If the Borrower were to be audited, investigated, reviewed or subject to suit and if there is any adverse finding in such audit, investigation, review or suit or if the Borrower were alleged, or determined, not to qualify for the loan or alleged, or found, to have made false certifications in connection with the loan, the Borrower could be required to return the full amount of the PPP Loan, which would reduce our liquidity, and would subject it to fines and penalties, and exclusion from government contracts. In particular, the Borrower may become subject to actions under the federal False Claims Act, or the FCA, including its qui tam provisions, which, among other things, prohibits persons from knowingly filing, or knowingly causing to be filed, a false statement, or knowingly using a false statement, to obtain payment from the federal government. Violations of the FCA are subject to treble damages and penalties. In the case of a PPP Loan, the government could allege that single damages are the amount of the loan and interest thereon (or more), which under the FCA could then be trebled. Substantial penalties must also be imposed for each submitted false statement when a defendant loses an FCA trial. FCA cases may be initiated by the U.S. Department of Justice or by private persons or entities, often called "whistleblowers," who bring the action on behalf of the United States. Recently, certain participants in the PPP have received inquiries from the SBA or other governmental entities regarding loans they received under the PPP. The Borrower may also face enforcement arising under other federal statutes, including criminal laws, and administrative actions and investigations initiated by SBA or other governmental entities. Furthermore, if the Borrower is identified as an entity that the media, government officials or others seek to portray it as a business that should not have availed itself of PPP funding or should not have sought forgiveness, we may face negative publicity, which could have a materially adverse impact on its business and operations and on our business and operations as its parent.

Our efforts in developing and selling products in electric vehicle markets, including the recent contract with a U.S. automotive OEM and any future supply of our products to the automotive industry may subject us to increased financial, operational and legal risks that could materially adversely impact our business, financial conditions and results of operations and may also increase our costs and make it difficult for us to operate profitably.

We have a focus on developing and selling products in the automotive industry, specifically for electric vehicle applications. We have recently entered into a contract with a U.S. automotive OEM to supply our thermal barrier products for use in the batteries of electric vehicles and we are continuing efforts to develop further products and sell to others in the electric vehicle market. As a result of our existing contract with the automotive OEM and any future supply of our products to the automotive industry, including through specific contracts, we are subject to a number of risks, including, but not limited to:

- Under our contract with a U.S. automotive OEM, the U.S. automotive OEM is not obligated to make any purchases from us and may terminate the contract at any time. There can be no assurance that significant revenue, or any revenue at all, will result from the contract.
- In order to support the projections and estimates of our product demand that our potential automotive customers present to us, we may need to make substantial capital and other investments without any assurance that such potential demand will materialize. For example, under the contract with the U.S. automotive OEM, we are obligated to supply products up to a daily maximum quantity even without a specific purchase commitment. This requires us to invest in capacity,

infrastructure and personnel. These investments could result in substantial capital expenditures without any commensurate increase in revenue, or any increase at all. Even if significant sales of our products to automotive OEMs materialize, the need to make these significant capital investments, as well as the costs related to developing these products and related process and manufacturing developments, and the costs of meeting the stringent requirements of the automotive industry, could result in sales to the automotive industry being significantly less profitable than we expect, or potentially unprofitable.

- Automotive OEMs require that we timely meet stringent requirements with respect to capital investment and quality standards in connection with our
 efforts to develop, sell and support products for use in the electric vehicle market. We may not be able to meet these requirements on a timely basis or at
 all.
- Automotive OEMs require suppliers of various tiers to assume liability for ordinary warranty expenses and product liability issues that are not necessarily commensurate with the roles the supplier played in the development of the final product sold to the consumer. This could expose us to significantly greater risk of liability for warranty expenses and/or for defects, failures or accidents involving the final products sold to the consumer.
- Automotive OEMs purchasing from us may have certain rights to intellectual property developed by us in connection with our work for that OEM. These
 rights could permit the OEM to purchase products similar to ours from other third party suppliers or to develop internally products that could replace our
 products in their manufacturing process.
- We face significant competition in selling our products to the automotive industry and anticipate that competition increasing over time, both from products similar to ours and from other technologies that may address in a superior fashion the technical issues currently addressed by our products. In particular, we face significant competition from Chinese firms, many of whom have longstanding experience in supplying electric vehicle OEMs and are part of a Chinese electric vehicle industry that we believe is in many ways more mature than the electric vehicle industry in the United States and other markets. In order to compete with such firms and sustainably participate in the automotive market, we will have to overcome the advantages possessed by those Chinese firms.
- Electric vehicles and battery technologies are evolving at a rapid pace. They may evolve in such a way as to render our products obsolete. While we are investing considerable capital and other resources based on what we believe to be the currently identified needs of the industry, our belief as to the current needs of the industry may be incorrect or our technology, products or other resources may not be applicable to the future needs of the industry.

Our ability to successfully sell our products to the automotive industry will depend in large part on our ability to manage these and other risks.

Trends in adoption of cathode chemistries may adversely affect the adoption of our silicon-rich carbon aerogels in anodes.

Success in adoption of our silicon rich anode materials depends on the need for matching cathode chemistries requiring high anode performance. Cathodes typically comprise oxides of metals such as nickel, manganese, aluminum and cobalt. One current trend is towards developing a higher nickel and lower (or no) cobalt-based cathode. Such cathodes require a matching higher performance anode like those manufactured with our silicon-rich carbon aerogel materials. Another trend is to use lower capacity, but safer cathode chemistries such as lithium iron phosphate (LFP). Certain battery manufacturers and automotive OEMs have already brought vehicles to the market with LFP cathodes. While vehicles with LFP cathodes may have lower energy densities leading to lower driving ranges, they are safer and have lower costs. If mass market adoption of lower performance chemistries such as LFP are continued, the demand for higher performing anodes such as our silicon-rich carbon aerogel materials will be less or limited to higher end vehicles thus limiting our market participation.

Our estimates regarding market opportunity for our products in the electric vehicle market and the assumptions on which our financial targets are based may prove to be inaccurate, which may cause our actual results to materially differ from such targets, which may adversely affect our future profitability, cash flows and stock price.

Our estimates regarding market opportunity for our products in the electric vehicle market, the assumptions underlying our estimates regarding market opportunity and our financial targets, including any revenue targets we may provide from time to time, are dependent on certain estimates and assumptions related to, among other things, category growth, development and launch of innovative new products, market share projections, product pricing and sale, volume and product mix, and volatility, material prices, distribution, cost savings, and our ability to generate sufficient cash flow to reinvest in our existing business. The estimates and financial targets are based on our management's best estimate of the probable results of our operations, based on present circumstances, and have not been reviewed by our independent accountants. These estimates and financial targets are based on several assumptions, set forth therein, which our management believes are reasonable. Some assumptions upon which the estimates and

financial targets are based, however, invariably will not materialize due to the inevitable occurrence of unanticipated events and circumstances beyond our management's control. Our estimates regarding market opportunity and our financial targets are based on historical experience and on various other estimates and assumptions that we believe to be reasonable under the circumstances and at the time they are made, and our actual results may differ materially from our expectations. Any material variation between our estimates and financial targets and our actual results may adversely affect our future profitability, cash flows and stock price.

Risks Related to Our Intellectual Property

Our inability to protect our intellectual property rights could negatively affect our business and results of operations.

Our ability to compete effectively depends in part upon developing, maintaining and/or protecting intellectual property rights relevant to our aerogel product forms, applications, manufacturing technologies and brand names. We rely principally on a combination of patent protection, trade secret laws, confidentiality and nondisclosure agreements, trademark registrations, common law rights and licensing arrangements to establish and protect the intellectual property rights relevant to our business. However, these measures may not be adequate in every given case to permit us to gain or keep any competitive advantage, particularly in those countries where the laws do not protect our proprietary rights as fully as or where the enforcement tools are weaker or less effective than those in the United States. In particular, since aerogels were developed approximately 80 years ago, there has been a wide range of research, development and publication related to aerogels, which makes it difficult to establish intellectual property rights to many key elements of aerogel technology and to obtain patent protection. Accordingly, much of the general technology that we use in our manufacture of aerogel blankets is not protected by patents.

Where we consider it appropriate, our strategy is to seek patent protection in the United States and other countries on technologies used in or relating to our aerogel product forms, applications and manufacturing technologies. As of December 31, 2020, we had 49 issued U.S. patents and 95 issued foreign patents, including seven U.S. patents and 23 foreign patents that we co-own with third parties. The issuance of a patent is not conclusive as to its scope, validity or enforceability. Thus, any patent held by us or to be issued to us from a pending patent application, could be challenged, invalidated or held unenforceable in litigation or proceedings before the USPTO and/or other patent tribunals in the United States or in foreign jurisdictions. Third parties could develop technologies that circumvent the patent protection we have secured. No consistent policy regarding the breadth of patent claims has emerged to date in the United States and the landscape could become more uncertain in view of future rule changes by the USPTO, the introduction of patent reform legislation and decisions in patent law cases by the federal courts including the United States Supreme Court.

The patent landscape outside the United States is even less predictable. As a result, the validity and enforceability of patents cannot be predicted with certainty. For example, we are aware of competitors that manufacture and market aerogel insulation products in China, where it may be difficult for us to enforce our intellectual property rights against these or other competitors.

In May 2016, we filed a complaint for patent infringement against Nano Tech Co., Ltd. (Nano), and Guangdong Alison Hi Tech., Ltd. (Alison) in the International Trade Commission, or ITC. In the ITC complaint, we alleged that these two China-based companies have engaged and are engaging in unfair trade practices by importing aerogel products in the United States that infringe, and/or are manufactured by processes that infringe, several of our patents in violation of Section 337 of the Tariff Act of 1930. In the ITC complaint, we sought exclusion orders from the ITC that direct the United States Customs and Border Protection to stop the importation of these infringing products. In February 2018, the ITC issued its final determination confirming the ALJ's previous initial determination that Nano and Alison had infringed asserted Aspen patents and that they have not proven the patents are invalid except with respect to one dependent product claim, which the ITC found was not infringed. The ITC affirmed that Alison and Nano each violated Section 337 of the Tariff Act and issued a limited exclusion order prohibiting importation of infringing aerogel insulation products manufactured by Alison and Nano. Alison unsuccessfully appealed the ITC determination with respect to a product patent to the CAFC, which affirmed the validity of Aspen's patent. The exclusion order, which is enforced by the United States Customs and Border Protection, is currently in effect. Additionally, the USPTO denied Alison's requests to invalidate the claims of four of Aspen's patents in Inter-Partes Review. Alison also filed multiple similar requests with the SIPO, seeking to invalidate our Chinese manufacturing process patents and two of our Chinese product patents. With respect to one of those request, not withdrawn previously by Alison, the PRB, issued a decision upholding the validity of Aspen's issued patent as amended in the proceedings. Alison has appealed the PRB's decision to the Beijing IP court. After the oral hearing at the Beijing IP court, we are awaiting the decision by the court. Nano has also filed a request seeking invalidation of a product patent at PRB of SIPO on which oral hearing took place in July 2019. After the oral hearing, Nano withdrew its invalidation request. On September 23, 2019, Alison filed yet another request to invalidate the same patent, whose prior validity opinion by PRB is currently on appeal at the Beijing IP Court. After conducting an oral hearing, PRB issued a decision on January 23, 2020 denying Alison's latest invalidation request of this patent.

In April 2016, we also filed a patent infringement suit at the District Court in Mannheim, Germany (Mannheim court), against Nano, Alison and two European resellers asserting their infringement of one of our German patents. We subsequently asserted

infringement of another three patents against Nano, Alison and a European reseller of Alison's products at the Mannheim court. We have since settled with one European reseller in exchange for a commitment not to procure infringing products and cooperation with our case. In January 2018, the court issued a series of judgments by acknowledgement (German, "Anerkenntnisurteil") finding the second reseller, Hiltex, liable for infringement and also issued injunctions against Hiltex. The judgments resulted from a settlement agreement in which Hiltex agreed not to resell the infringing products in Europe where at least one of the asserted patents are active. Nano and Alison also initiated nullity actions in German Federal Patent Court in Munich against our asserted German patents.

On March 8, 2019, Mannheim court issued two separate judgments in the cases against Nano and Alison, respectively. The Mannheim court determined that both Nano and Alison are infringing on Aspen's EP1638750 (750 Patent) in connection with their respective products. The court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing the infringing products. The court found the defendants liable to us for damages since September 22, 2012. The court also ordered the defendants to provide information on the scope of the acts of infringement committed since August 22, 2012, and a recall of infringing products. The court also ordered Nano and Alison to bear the costs of the legal proceedings and reimburse statutory attorneys' costs and expenses to us, that exact amount of which is yet to be determined. Nano and Alison have appealed the judgments of the Mannheim Court. The appeal is currently ongoing. The Federal Patent Court in Munich previously dismissed the challenge to the validity of 750 Patent which has become final.

Nano and Alison also filed an opposition to one of the asserted patents at the EPO. In December 2018, the opposition division of EPO determined the patent, EP2813338 (338 Patent), was invalid on formality grounds and decided to revoke it, which determination is currently under appeal at the EPO Board of appeals. On March 19 and 20, 2019 the German Federal Patent Court in Munich conducted oral proceedings and voided four claims in EP2415577 (577 Patent) and confirmed the validity of challenged claims in EP2422950 (950 Patent) within the scope of silica gels. The Mannheim court issued two judgments on December 23, 2019 finding that Alison infringed 577 Patent and 950 Patent and also issued injunctions prohibiting Alison from continuing infringement in connection with any aerogel sheets. As of March 9, 2021, we are unaware of any timely appeal of these December 2019 decisions by Alison. Upon confirmation of the same by the Mannheim Court, we expect the decisions to become final. The infringement proceedings at the Mannheim court based on 577 Patent and 950 Patent are currently ongoing against Nano.

Additionally, a reseller of Nano's products in Taiwan challenged the validity of one of our patents in Taiwan in 2018. After careful review of our written response, the Taiwanese patent office has determined the patent as valid and dismissed the challenge in December 2018. In 2018, LG Chem Ltd. challenged the validity of one of our patents in Korea at the IPTAB of the Korean Intellectual Property Office. After conducting an oral hearing, the IPTAB issued a decision on November 30, 2019 upholding claims related to aerogel sheets incorporating fibers and invalidating claims for aerogel sheets not incorporating fibers. The IPTAB decision is currently on appeal at the Korean Patent Court.

Due to their nature, it is difficult to predict the outcome or the costs involved in any litigation or administrative proceedings, including any appeals process. Furthermore, the counter-parties in these proceedings may have significant resources and interest to litigate and therefore, these litigation matters could be protracted and may ultimately involve significant legal expenses. In addition to the foregoing, we have been and may be from time to time a party to other legal proceedings that arise in the ordinary course of business and to other patent enforcement actions to assert our patent rights.

In addition, we may fail to apply for patents on important technologies or innovative products in a timely fashion, if at all, and our existing and future patents may not be sufficiently broad to prevent others from practicing our technologies or from developing competing products or technologies, in particular given the long history of aerogel development. Furthermore, third parties could practice our intellectual property rights in territories where we do not have patent protection or where processes for remedies for infringement of intellectual property or unclear or still evolving. Such third parties may then try to import products made using our intellectual property rights into the United States or other countries. We may not be able to prevent such imports practically even if we obtain appropriate legal remedies. Our strategy is to seek registration of trademarks for our brands in many, but not all, of the jurisdictions in which we sell our products based on various factors, including our sales volumes in the jurisdiction, our ability to enforce local laws and cost. Our strategy may not be adequate to protect our brands in all circumstances, especially in foreign jurisdictions. In certain jurisdictions, third parties may seek to register trademarks on the names of our products and brands before we do thus requiring us to change branding strategies or otherwise deal with the issue.

As of December 31, 2020, we had 29 pending U.S. patent applications and 84 pending foreign patent applications, including two pending U.S. patent application and ten foreign pending patent applications that we co-own with other third parties. Our pending patent applications are directed to various enabling technologies for the product forms, applications and manufacturing technologies that support our current business, as well as aspects of products under development or contemplated for the future. The issuance of patents from these applications involves complex legal and factual questions and, thus, we cannot provide assurance that any of our pending patent applications will result in the issuance of patents to us. The USPTO, relevant foreign patent offices and other relevant patent tribunals may deny or require significant narrowing of claims in our pending patent applications. Patents issued as a result of any of our pending patent applications may not cover our enabling technology and/or the products or processes that support our

current or future business or afford us with significant commercial protection against others with similar technology. Proceedings before the USPTO could result in adverse decisions as to the priority of our inventions and the narrowing or invalidation of claims in issued patents. In addition, our pending patent applications filed in foreign countries are subject to laws, rules and procedures that differ from those of the United States, and thus foreign patent applications may not be granted even if counterpart United States patents are issued.

We have initiated intellectual property litigation that is and will continue to be costly, and could limit or invalidate our intellectual property rights, divert time and efforts away from business operations, require us to pay damages and/or costs and expenses and/or otherwise have an material adverse impact on our business, and we could become subject to additional such intellectual property litigation in the future.

The success of our business is highly dependent on protecting our intellectual property rights. Unauthorized parties may attempt to copy or otherwise obtain and use our products and/or enabling technology. Policing the unauthorized use of our intellectual property rights is difficult and expensive, as is enforcing these rights against unauthorized use by others. Identifying unauthorized use of our intellectual property rights is difficult because we may be unable to monitor the technologies and/or materials being employed by other parties. The steps we have taken or will take may not prevent unauthorized use of our intellectual property rights, particularly in foreign countries where enforcement of intellectual property rights may be more difficult than in the United States.

In May 2016, we filed a complaint for patent infringement against Nano Tech Co., Ltd. (Nano), and Guangdong Alison Hi Tech., Ltd. (Alison) in the International Trade Commission, or ITC. In February 2018, the ITC issued its final determination that Nano and Alison had infringed asserted Aspen patents and that they have not proven the patents are invalid except with respect to one dependent product claim, which the ITC found was not infringed. The ITC affirmed that Alison and Nano each violated Section 337 of the Tariff Act and issued a limited exclusion order prohibiting importation of infringing aerogel insulation products manufactured by Alison and Nano. Alison's appeal with respect to a product patent to the United States Court of Appeals for the Federal Circuit (CAFC) was rejected, and resulted in CAFC affirming the validity of our patent. The exclusion order, which is enforced by the United States Customs and Border Protection, is currently in effect.

Additionally, the USPTO denied Alison's requests to invalidate the claims of four of our patents in Inter-Partes Review. Alison also filed multiple similar requests with the Chinese Patent Office (SIPO), seeking to invalidate our Chinese manufacturing process patents and two of our Chinese product patents. With respect to one of those requests, not withdrawn previously by Alison, the Patent Review Board of SIPO (PRB), issued a decision upholding the validity of Aspen's issued patent as amended in the proceedings. Alison has appealed the PRB's decision to the Beijing IP court. On July 25, 2020, the Beijing IP court dismissed Alison's appeal and upheld the validity of Aspen's patent and we received this decision on September 15, 2020. Nano has also filed a request seeking invalidation of a product patent at SIPO. After the oral hearing at PRB, Nano withdrew its invalidation request. On September 23, 2019, Alison filed yet another request to invalidate the same patent, whose validity was previously confirmed by PRB. On January 23, 2020 PRB denied Alison's latest invalidation request.

In April 2016, we also filed a patent infringement suit at the District Court in Mannheim, Germany (Mannheim court), against Nano, Alison and two European resellers asserting their infringement of one of our German patents. We subsequently asserted infringement of another three patents against Nano, Alison and a European reseller of Alison's products at the Mannheim court. We have since settled with one European reseller in exchange for a commitment not to procure infringing products and cooperation with our case. In January 2018, the court issued a series of judgments by acknowledgement (German, "Anerkenntnisurteil") finding the second reseller, Hiltex, liable for infringement and also issued injunctions against Hiltex. The judgments resulted from a settlement agreement in which Hiltex agreed not to resell the infringing products in Europe where at least one of the asserted patents are active. On March 8, 2019, the Mannheim court issued two separate judgments in cases against Nano and Alison, respectively. The Mannheim court determined that both Nano and Alison are infringing on Aspen's EP1638750 (750 Patent) in connection with their respective products. The court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing the infringing products. The court found the defendants liable to us for damages since September 22, 2012. The court also ordered the defendants to provide information on the scope of the acts of infringement committed since August 22, 2012, and a recall of infringing products. The court ordered Nano and Alison to bear the costs of the legal proceedings and reimburse statutory attorneys' costs and expenses to us, that exact amount of which is yet to be determined. Nano and Alison have appealed the judgments of the Mannheim court. Nano subsequently withdrew the appeal while Alison's appeal is currently pending.

The Mannheim court issued two decisions on December 23, 2019 finding that Alison infringed the 577 Patent and the 950 Patent and also issued injunctions prohibiting Alison from continuing infringement in connection with any aerogel sheets. The December 2019 decisions against Alison have now become final and binding. The Mannheim court issued two decisions on July 31, 2020 finding that Nano infringed each of the 577 Patent and the 950 Patent. In addition to granting other remedies, the court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing any aerogel sheets. After the passing of deadline to file appeals, these decisions have now become final.

Nano and Alison also initiated nullity actions in German Federal Patent Court in Munich against our asserted German patents. On September 25, 2018, the Federal Patent Court in Munich dismissed the challenge to the validity of 750 Patent which has subsequently become final. Nano and Alison also filed an opposition to one of the asserted patents at the EPO. In December 2018, the opposition division of EPO determined the patent, EP2813338 (338 Patent), was invalid on formality grounds and decided to revoke it, which determination is currently under appeal at the EPO Board of appeals. On March 19 and 20, 2019 the German Federal Patent Court in Munich (FPC) conducted oral proceedings and voided four claims in EP2415577 (577 Patent) and confirmed the validity of challenged claims in EP2422950 (950 Patent) within the scope of silica gels. These FPC judgments are now final and binding on the parties. Nano had filed another nullity action seeking to invalidate the remaining claims in the 577 Patent which action Nano subsequently failed to pursue. On June 17, 2020, Nano also filed an opposition to a recently issued Aspen Patent EP3120983B1, titled "Continuous Sheet of Gel Materials and Continuous sheet of Aerogel".

Additionally, a reseller of Nano's products in Taiwan challenged the validity of one of our patents in Taiwan in 2018. After careful review of our written response, the Taiwanese patent office has determined the patent as valid and dismissed the challenge in December 2018. In 2018, LG Chem Ltd. challenged the validity of one of our patents in Korea at the IPTAB of the Korean Intellectual Property Office. After conducting an oral hearing, the IPTAB issued a decision on November 30, 2019 upholding claims related to aerogel sheets incorporating fibers. On January 14, 2021 the Korean Patent Court confirmed the validity of the claims related to aerogel sheets incorporating fibers.

Due to their nature, it is difficult to predict the outcome or the costs involved in any litigation or administrative proceedings, including any appeals process. Furthermore, the counter parties in these proceedings may have significant resources and interest to litigate and therefore, these litigation matters could be protracted and may ultimately involve significant legal expenses. In addition to the foregoing, we have been and may be from time to time party to other legal proceedings that arise in the ordinary course of business and to other patent enforcement actions to assert our patent rights.

Our continued commercial success will also depend in part upon not infringing the patents or violating other intellectual property rights of third parties. We are aware of patents and patent applications generally relating to aspects of our technologies filed by, and issued to, third parties. Our knowledge of the patent landscape with respect to the technologies currently embodied within our aerogel products and the technologies that we practice in manufacturing those products indicates that the third-party patent rights most relevant to our business are those owned by Cabot and licensed to us under the cross license agreement with Cabot. Nevertheless, we cannot determine with certainty whether patents or patent applications of other parties may materially affect our ability to conduct our business. There may be existing patents of which we are unaware that we may inadvertently infringe, resulting in claims against us or our customers. In recent years, Chinese, Japanese and South Korean entities have filed a significant number of patent applications related to aerogel products in both their home countries and in foreign countries. These patents in application areas of aerogels may make it more difficult for OEMs and end-use customers in these countries to use our products in new and different applications, which in turn may limit our ability to penetrate new markets.

In the event that the manufacture, use and/or sale of our products or technologies is challenged, or if our product forms or technologies conflict with patent rights of others or our operations conflict with trademark or similar rights of others, third parties could bring legal actions against us in the United States, Europe or other countries, claiming damages and seeking to enjoin the manufacturing and/or marketing of our products. In addition, it is not possible to predict with certainty what patent claims may arise from pending patent applications of third parties. In the United States, for example, patent prosecution can proceed in secret prior to issuance of a patent, provided such application is not filed in a foreign jurisdiction. For U.S. patent applications that are also filed in foreign jurisdictions, such patent applications will not be published until 18 months from the filing date of the application. As a result, third parties may be able to obtain patents with claims relating to our product forms, applications and/or manufacturing processes which they could attempt to assert against us or our end-users.

In the case of any of the above, litigation may be necessary to enforce, protect or defend our intellectual property rights or to determine the validity and scope of the intellectual property rights of others. Any such litigation, including our ongoing patent enforcement actions described above, could be unsuccessful, cause us to incur substantial costs, divert resources and the efforts of our personnel away from daily operations, harm our reputation and/or result in the impairment of our intellectual property rights. In some cases, litigation may be threatened or brought by a patent holding company (otherwise known as non-practicing entities or patent "trolls") or other adverse patent owner who has no relevant product revenues and against which our patents may provide little or no deterrence. If we are found to infringe any patents, regardless of whether litigation is brought against us by third parties or, as in the case of our ongoing patent enforcement actions described above, brought by us against third parties, we could be required to:

- pay substantial monetary damages, including lost profits, reasonable royalties and/or treble damages if an infringement is found to be willful;
- totally discontinue or substantially modify any products or processes that are found to be in violation of another party's intellectual property rights; and/or

• seek a license to continue making and selling our products and/or using our manufacturing processes, which we may not be able to obtain on reasonable terms, if at all, which could significantly increase our operating expenses and/or decrease our revenue.

In the actions brought by us against third parties, including our ongoing patent enforcement actions described above, we may be required to pay costs and expenses of opposing parties, including attorney fees, if we lose.

If our competitors are able to use our technology without payment to us, our ability to compete effectively could be materially harmed. Our contracts generally indemnify our customers for third-party claims of intellectual property infringement related to the manufacture and use of our products, and typically up to the amount of the purchase price paid for the product, which could cause us to become involved, and subject to liability, in litigation between our customers and third parties. The expense of defending these claims may adversely affect our results of operations.

Patents covering technologies that are similar or superior to our technologies may be developed or obtained by third parties. We may need to seek licenses to these technologies, which could limit our ability to manufacture our products and have a material adverse effect on our business and results of operations.

Competitors or other third parties may independently develop and obtain patents covering technologies that are similar or superior to the product forms, applications or manufacturing technologies that we employ. In such event, we may need to obtain licenses for these technologies. However, we may not be able to obtain licenses on reasonable terms, if at all, which could limit our ability to manufacture our current and/or future products and operate our business.

Our contracts with the U.S. government and other third parties could negatively affect our intellectual property rights.

To further our product development efforts, our scientists and engineers work closely with customers, the U.S. government and other third parties to research and develop advancements in aerogel product forms, applications and manufacturing technologies. We have entered into agreements with private third parties and have been awarded numerous research contracts with the U.S. government to independently or jointly research, design and develop new devices and systems that incorporate aerogel material. In some instances, the research and development activities that we conduct under contract with the U.S. government and/or with private third parties may produce intellectual property to which we may not have ownership or exclusive rights and will be unable to protect or monetize.

Moreover, when we develop new technologies using U.S. government funding, the government may obtain certain rights in any resulting patents, technical data and/or other confidential and proprietary information, generally including, at a minimum, a non-exclusive license authorizing the U.S. government to use the invention, technical data or software for non-commercial purposes. Federal government funding may limit when and how we can deploy our technology developed under those contracts. In addition, inventions must be reported promptly to the funding agencies, the federal funding must be disclosed in any resulting patent applications, and our rights in such inventions will normally be subject to government license rights, periodic post-contract utilization reporting, foreign manufacturing restrictions and "march-in" rights. March-in rights refer to the right of the U.S. government to require us to grant a license to the technology to a responsible applicant or, if we refuse, the government may grant the license itself. The U.S. government may exercise its march-in rights if it determines that action is necessary because we fail to achieve practical application of any technology developed under contract with the government or because action is necessary to alleviate health or safety needs, to meet requirements of federal regulations or to give preference to United States industry. The U.S. government may also have the right to disclose our confidential and proprietary information to third parties. In addition, failure to comply with all the government contract requirements may result in us losing the patent rights.

Our U.S. government-sponsored research contracts are also subject to audit and require that we provide regular written technical updates on a monthly, quarterly or annual basis, and, at the conclusion of the research contract, a final report on the results of our technical research. Because these reports are generally available to the public, third parties may obtain some aspects of our confidential and proprietary information relating to our product forms, applications and/or manufacturing processes. If we fail to provide these reports or to provide accurate and complete reports, the U.S. government could obtain rights to any intellectual property arising from the related research.

Furthermore, there could be disputes between us and a private third party as to the ownership rights to any inventions that we develop in collaboration with such third party. Any such dispute may cause us to incur substantial costs including potential license obligations, and could place a significant strain on our financial resources, divert the attention of management from our core business and harm our reputation.

We rely on trade secrets to protect our technology, and our failure to obtain or maintain trade secret protection could materially adversely affect our competitive business position.

We rely in part on trade secret protection to protect confidential and proprietary information relating to our technology, particularly where we do not believe patent protection is appropriate or obtainable. We continue to develop and refine the manufacturing technologies used to produce our aerogel products and believe that we have already developed, and will continue to develop, significant know-how related to these technologies. However, trade secrets can be difficult to protect. We may not be able to maintain the secrecy of this information and competitors may develop or acquire equally or more valuable information related to the manufacture of comparable aerogel products. Our strategy for scale-up of commercial production will continue to require us to share confidential and proprietary information with the U.S. government and other third parties. While we take reasonable efforts to protect our trade secrets, our employees, consultants, contractors or scientific and other advisors, or those of our business partners, may intentionally or inadvertently disclose our confidential and proprietary information to competitors. Any enforcement of claims by us that a third party has obtained and is using our trade secrets is expensive, time consuming and uncertain. In addition, foreign courts are sometimes less willing than United States courts to protect trade secrets.

We require all employees and consultants to execute confidentiality and/or nondisclosure agreements upon the commencement of an employment or consulting arrangement with us, which agreements generally require that all confidential and proprietary information developed by the individual or made known to the individual by us during the course of the individual's relationship with us be kept confidential and not disclosed to third parties. These agreements further generally provide that inventions conceived by the individual in the course of rendering services to us will be our exclusive property. Nevertheless, these agreements may not be honored and our confidential and proprietary information may be disclosed, or these agreements may be unenforceable or difficult to enforce. We also require customers and vendors to execute confidentiality and/or nondisclosure agreements. However, we have not obtained such agreements from all of our customers and vendors. Moreover, some of our customers may be subject to laws and regulations that require them to disclose information that we would otherwise seek to keep confidential. Our confidential and proprietary information may be otherwise disclosed without our authorization or knowledge. Moreover, third parties could reverse engineer our manufacturing processes, independently develop substantially equivalent confidential and proprietary information or otherwise gain access to our trade secrets. Additionally, cyber security threats, especially originating from countries such as China, Russia, Iran and North Korea as broadly reported in the media, pose a significant risk to maintaining control of our trade secrets. Failure to maintain trade secret protection could enable others to produce competing products and adversely affect our competitive business position.

Loss of the intellectual property rights that we license from Cabot Corporation would have a material adverse impact on our business.

We have licensed certain intellectual property rights from Cabot under a cross license agreement. These intellectual property rights have been critical to the manufacture of our existing products and may also be important to our research, development and manufacture of new products. Any loss of the intellectual property rights granted to us thereunder, including as a result of ineffective protection of such rights by Cabot, abandonment or expiration of the involved patents or a breach of or dispute under the agreement by either party would have a material adverse impact on our financial condition, results of operations and growth prospects, and might prevent us from continuing our business.

Risks Related to Our Data Privacy and Other Personal Information

We may be subject to, or may in the future become subject to, U.S. federal and state, and foreign laws and regulations imposing obligations on how we collect, use, disclose, store and process personal information. Our actual or perceived failure to comply with such obligations could result in liability or reputational harm and could harm our business. Ensuring compliance with such laws could also impair our efforts to maintain and expand our customer base, and thereby decrease our revenue.

We are subject to laws and regulations governing data privacy and other personal information. These laws and regulations govern our processing of personal data, including the collection, access, use, analysis, modification, storage, transfer, security breach notification, destruction and disposal of personal data. We must comply with laws and regulations associated with the international transfer of personal data based on the location in which the personal data originates and the location in which it is processed. Although there are legal mechanisms to facilitate the transfer of personal data from the European Economic Area, or EEA, and Switzerland to the United States, the decision of the European Court of Justice that invalidated the safe harbor framework has increased uncertainty around compliance with EU privacy law requirements. As a result of the decision, it was no longer possible to rely on safe harbor certification as a legal basis for the transfer of personal data from the European Union to entities in the United States. In February 2016, the European Commission announced an agreement with the Department of Commerce, or DOC, to replace the invalidated safe harbor framework with a new EU-U.S. "Privacy Shield." On July 12, 2016, the European Commission adopted a decision on the adequacy of the protection provided by the Privacy Shield. The Privacy Shield is intended to address the requirements set out by the European Court of Justice in its recent ruling by imposing more stringent obligations on companies, providing stronger monitoring and enforcement by the DOC and Federal Trade Commission and making commitments on the part of public authorities regarding access to information.

The privacy and security of personally identifiable information stored, maintained, received or transmitted, including electronically, is subject to significant regulation in the United States and abroad. While we strive to comply with all applicable privacy and security laws and regulations, legal standards for privacy continue to evolve and any failure or perceived failure to comply may result in proceedings or actions against us by government entities or others, or could cause reputational harm, which could have a material adverse effect on our business.

U.S.-based companies may certify compliance with the privacy principles of the Privacy Shield. Certification to the Privacy Shield, however, is not mandatory. If a U.S.-based company does not certify compliance with the Privacy Shield, it may rely on other authorized mechanisms to transfer personal data.

The privacy and data security landscape is still in flux. In October 2016, an action for annulment of the European Commission decision on the adequacy of Privacy Shield was brought before the European Court of Justice by three French digital rights advocacy groups, La Quadrature du Net, French Data Network and the Fédération FDN. This case, Case T-738/16, is currently pending before the European Court of Justice. Should the European Court of Justice invalidate the Privacy Shield, it will no longer be possible to transfer data from the European Union to entities in the United States under a Privacy Shield certification, in which case other legal mechanisms would need to be put in place.

The legislative and regulatory landscape for privacy and data security continues to evolve, and there has been an increasing focus on privacy and data security issues which may affect our business. Failure to comply with current and future laws and regulations could result in government enforcement actions (including the imposition of significant penalties), criminal and civil liability for us and our officers and directors, private litigation and/or adverse publicity that negatively affects our business.

If we or our vendors fail to comply with applicable data privacy laws, or if the legal mechanisms we or our vendors rely upon to allow for the transfer of personal data from the EEA or Switzerland to the United States (or other countries not considered by the European Commission to provide an adequate level of data protection) are not considered adequate, we could be subject to government enforcement actions and significant penalties against us, and our business could be adversely impacted if our ability to transfer personal data outside of the EEA or Switzerland is restricted, which could adversely impact our operating results. The EU General Data Protection Regulation, which was effective as of May 25, 2018, introduced new data protection requirements in the European Union relating to the consent of the individuals to whom the personal data relates, the information provided to the individuals, the documentation we must retain, the security and confidentiality of the personal data, data breach notification and the use of third party processors in connection with the processing of personal data. The EU General Data Protection Regulation has increased our responsibility and potential liability in relation to personal data that we process, and we may be required to put in place additional mechanisms to ensure compliance with the EU General Data Protection Regulation. However, our ongoing efforts related to compliance with the EU General Data Protection Regulation differently, and guidance on implementation and compliance practices are often updated or otherwise revised, which adds to the complexity of processing personal data in the European Union.

In the United States, California recently adopted the California Consumer Privacy Act of 2018, or CCPA, which came into effect in January 2020. The CCPA has been characterized as the first "GDPR-like" privacy statute to be enacted in the United States because it mirrors a number of the key provisions of the EU General Data Protection Regulation. The CCPA establishes a new privacy framework for covered businesses by creating an expanded definition of personal information, establishing new data privacy rights for consumers in the State of California, imposing special rules on the collection of consumer data from minors, and creating a new and potentially severe statutory damages framework for violations of the CCPA and for businesses that fail to implement reasonable security procedures and practices to prevent data breaches.

Risks Related to Our Common Stock

We have incurred and will continue to incur increased costs and demands upon management as a result of complying with the laws and regulations affecting public companies in the United States, which may adversely affect our results of operations.

As a public company, and particularly now that we are no longer an emerging growth company as of December 31, 2019, we have incurred and will continue to incur significant legal, accounting and other expenses that we did not incur as a private company. The Sarbanes-Oxley Act of 2002, the Dodd-Frank Wall Street Reform and Consumer Protection Act, the listing requirements of The New York Stock Exchange and other applicable securities rules and regulations impose various requirements on public companies, including establishment and maintenance of effective disclosure and financial controls and corporate governance practices. Our management and other personnel will need to devote a substantial amount of time to these compliance initiatives. Moreover, these rules and regulations will increase our legal and financial compliance costs and will make some activities more time-consuming. We are subject to the reporting requirements of the Exchange Act that require us to file, among other things, quarterly reports on Form 10-Q and annual reports on Form 10-K. Under Section 302 of the Sarbanes-Oxley Act of 2002, or the Sarbanes-Oxley Act, as a part of

each of these reports, our chief executive officer and chief financial officer are required to evaluate and report their conclusions regarding the effectiveness of our disclosure controls and procedures and to certify that they have done so. Effective internal controls are necessary for us to provide reliable financial reports and prevent fraud. Under Section 404 of the Sarbanes-Oxley Act, we have included a report of management on our internal control over financial reporting in our Form 10-K for our fiscal year ended December 31, 2020. In addition, since we are no longer an emerging growth company as of December 31, 2019, the independent registered public accounting firm auditing our financial statements is required to attest to and report on the effectiveness of our internal control over financial reporting for the year ended December 31, 2019 and subsequent years. We will also be required to hold a say-on-pay vote and a say-on-frequency vote at our 2021 Annual Meeting of Stockholders. The process of documenting our internal controls and complying with Section 404 is expensive and time consuming, and requires significant attention of management. As we are no longer an emerging growth company, we are subject to increased regulatory requirements necessitating additional resources and attention from management and will result in increased costs to us, which could include higher legal fees, accounting fees and fees associated with investor relations activities, among others.

Complying with these requirements applicable to public companies may place a strain on our personnel, information technology systems and resources while diverting management's attention from other business concerns. We have engaged outside service providers with appropriate public company compliance experience and technical accounting knowledge to support our compliance efforts. We may need to engage additional service providers to ensure compliance which may cause us to incur additional operating costs.

These and other requirements may also make it more difficult or more costly for us to obtain or maintain certain types of insurance, including directors' and officers' liability insurance. We may be forced to accept reduced policy limits and coverage or incur substantially higher costs to obtain the same or similar coverage.

The impact of these requirements could also make it more difficult for us to attract and retain qualified persons to serve on our board of directors, our board committees or as executive officers. Any one of these requirements could have a material adverse effect on our business, financial condition and results of operations.

Because we are a public company, we are obligated to develop and maintain proper and effective internal control over financial reporting. If our internal controls over financial reporting are determined to be ineffective, or if our auditors are otherwise unable to attest to their effectiveness, investor confidence in our company, and our common stock price, may be adversely affected.

Pursuant to Section 404a of the Sarbanes-Oxley Act, we have furnished a report by management on the effectiveness of our internal control over financial reporting for the fiscal year ended December 31, 2020 and will continue to do so in each year thereafter. This assessment is required to include disclosure of any material weaknesses identified by our management in our internal control over financial reporting. Our independent registered public accounting firm is required to formally attest to the effectiveness of our internal control over financial reporting for the year December 31, 2019 and subsequent years.

We continue to assess our system of internal controls over financial reporting and successfully completed documentation necessary to perform the annual evaluation required to comply with Section 404. In future periods, we may discover, and not be able to remediate timely, significant deficiencies or material weaknesses. During the evaluation and testing process in 2020, we did not identify any material weaknesses in our internal controls over financial reporting. In future periods, if we were to identify one or more material weaknesses in our internal control, we may be unable to assert that our internal controls are effective. If we are unable to assert that our internal controls over financial reporting are effective, we could lose investor confidence in the accuracy and completeness of our financial reports or it could cause us to fail to meet our reporting obligations, which could have a material adverse effect on the price of our common stock. In addition, any failure to comply with Section 404 could subject us to a variety of administrative sanctions, including SEC action, ineligibility for short form resale registration, the suspension or delisting of our common stock from The New York Stock Exchange, and the inability of registered broker-dealers to make a market in our common stock, which would further reduce our stock price and could harm our business.

The trading market in our common stock has been limited and substantially less liquid than the average trading market for a stock quoted on The New York Stock Exchange.

Since our initial listing on The New York Stock Exchange on June 13, 2014, the trading market in our common stock has been limited and substantially less liquid than the average trading market for companies listed on The New York Stock Exchange. The listing of our common stock on The New York Stock Exchange does not assure that a meaningful, consistent and liquid trading market currently exists or will exist in the future. We cannot predict whether a more active market for our common stock will develop in the future. An absence of an active trading market could adversely affect our stockholders' ability to sell our common stock at current market prices in short time periods, or possibly at all. An inactive market may also impair our ability to raise capital by selling our common stock and may impair our ability to acquire other companies, products or technologies by using our common stock as

consideration. Additionally, analyst coverage of our common stock may be limited and such lack of coverage may have a depressive effect on the market price for our common stock. As of December 31, 2020, approximately 34.7% of our outstanding shares of common stock were held by our executive officers, directors, principal stockholders and their respective affiliates, which may adversely affect the liquidity of the trading market for our common stock, in as much as federal securities laws restrict sales of our shares by these stockholders. If our affiliates continue to hold their shares of common stock, there will be a more limited trading volume in our common stock, which may make it more difficult for investors to sell their shares or increase the volatility of our stock price.

We expect that the price of our common stock will fluctuate substantially, which could subject us to securities class action litigation and result in substantial losses to our stockholders.

The price of our common stock fluctuates in a broad range. For example, on December 21, 2018 the closing price of our shares of common stock was \$1.96, and on February 10, 2021, the closing price of our shares of common stock was \$26.00. Such fluctuations may be due to a number of factors, including the following, some of which are beyond our control:

- volume and timing of orders for our products;
- quarterly and yearly variations in our or our competitors' results of operations;
- our announcement or our competitors' announcements regarding new products, product enhancements, significant contracts, number of distributors, acquisitions or strategic investments;
- announcements of technological innovations relating to aerogels, thermal management and energy infrastructure insulation;
- results of operations or projections that vary from the expectations of securities analysts and investors;
- the periodic nature of our sales cycles, in particular for capital projects in the energy infrastructure market;
- our ability to develop, obtain regulatory clearance or approval for and market new and enhanced products on a timely basis;
- future sales of our common stock, including sales by our executive officers, directors and significant stockholders and their respective affiliates;
- announcements by third parties of significant claims or proceedings against us, including with regard to intellectual property and product liability;
- changes in accounting principles; and
- general U.S. and global economic conditions and other factors, including factors unrelated to our operating performance or the operating performance of our competitors.

Furthermore, the U.S. stock market has at times experienced extreme volatility that in some cases has been unrelated or disproportionate to the operating performance of particular companies. These broad market and industry fluctuations may adversely affect the market price of our common stock, regardless of our actual operating performance.

In the past, following periods of market volatility, stockholders have instituted securities class action litigation. If we become involved in securities litigation, it could have a substantial cost and divert resources and the attention of our senior management team from our business regardless of the outcome of such litigation.

Securities analysts may not continue coverage of our common stock or may issue negative reports, which may have a negative impact on the market price of our common stock.

The trading market for our common stock relies in part on the research and reports that industry or financial analysts publish about us or our business. Securities analysts may elect not to provide research coverage of our common stock. If securities analysts do not cover or continue to cover our common stock, the lack of research coverage may cause the market price of our common stock to decline. If one or more of the analysts who elects to cover us downgrades our stock, our stock price would likely decline substantially. If one or more of these analysts ceases coverage of us, we could lose visibility in the market, which in turn could cause our stock price to decline. In addition, rules mandated by the Sarbanes-Oxley Act and a global settlement reached in 2003 between the SEC, other regulatory agencies and a number of investment banks have led to a number of fundamental changes in how analysts are reviewed and compensated. In particular, many investment banking firms are required to contract with independent financial analysts for their stock research. It may be difficult for companies such as ours, with smaller market capitalizations, to attract independent financial analysts that will cover our common stock. This could have a negative effect on the market price of our stock.

Our directors, officers and principal stockholders have significant voting power and may take actions that may not be in the best interests of our other stockholders.

As of December 31, 2020, our executive officers, directors and principal stockholders and their affiliates collectively controlled approximately 34.7% of our outstanding shares of common stock. As a result, these stockholders, if they act together, may be able to control the management and affairs of our company and certain matters requiring stockholder approval, including the election of directors and approval of significant corporate transactions. This concentration of ownership may have the effect of delaying or preventing a change of control and might adversely affect the market price of our common stock. This concentration of ownership may not be in the best interests of our other stockholders.

Anti-takeover provisions in our restated certificate of incorporation and restated bylaws, and Delaware law, could delay or discourage a takeover.

Anti-takeover provisions in our restated certificate of incorporation and restated bylaws and Delaware law may have the effect of deterring or delaying attempts by our stockholders to remove or replace management, engage in proxy contests and effect changes in control. The provisions of our charter documents include:

- procedures for advance notification of stockholder nominations and proposals;
- the inability of our stockholders to call a special meeting of the stockholders and the inability of our stockholders to act by written consent;
- the ability of our board of directors to create new directorships and to fill any vacancies on the board of directors;
- the ability of our board of directors to amend our restated bylaws without stockholder approval; and
- the ability of our board of directors to issue up to 5,000,000 shares of preferred stock without stockholder approval upon the terms and conditions and with the rights, privileges and preferences as our board of directors may determine.

In addition, as a Delaware corporation, we are subject to Delaware law, including Section 203 of the Delaware General Corporation Law. In general, Section 203 prohibits a Delaware corporation from engaging in any business combination with any interested stockholder for a period of three years following the date that the stockholder became an interested stockholder unless certain specific requirements are met as set forth in Section 203. These provisions, alone or together, could have the effect of deterring or delaying changes in incumbent management, proxy contests or changes in control.

Our restated certificate of incorporation designates a state or federal court located within the State of Delaware as the exclusive forum for certain types of actions and proceedings that may be initiated by our stockholders, which could limit our stockholders' ability to obtain a favorable judicial forum for disputes with us or our directors, officers or employees.

Our restated certificate of incorporation provides that, subject to limited exceptions, a state or federal court located within the State of Delaware will be the exclusive forum for (1) any derivative action or proceeding brought on our behalf, (2) any action asserting a claim of breach of a fiduciary duty owed by any of our directors, officers or other employees to us or our stockholders, (3) any action asserting a claim against us arising pursuant to any provision of the Delaware General Corporation Law, our restated certificate of incorporation or our restated bylaws, or (4) any other action asserting a claim against us that is governed by the internal affairs doctrine. This exclusive forum provision does not apply to suits brought to enforce a duty or liability created by the Exchange Act. It could apply, however, to a suit that falls within one or more of the categories enumerated in the exclusive forum provision and asserts claims under the Securities Act, inasmuch as Section 22 of the Securities Act creates concurrent jurisdiction for federal and state courts over all suits brought to enforce any duty or liability created by the Securities Act or the rule and regulations thereunder. There is uncertainty as to whether a court would enforce such provision with respect to claims under the Securities Act, and our stockholders will not be deemed to have waived our compliance with the federal securities laws and the rules and regulations thereunder. Any person or entity purchasing or otherwise acquiring any interest in shares of our capital stock shall be deemed to have notice of and to have consented to the provisions of our restated certificate of incorporation described above. This choice of forum provision may limit a stockholder's ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers or other employees, which may discourage such lawsuits against us and our directors, officers and employees. Alternatively, if a court were to find these provisio

Our shareholders may experience future dilution as a result of future equity offerings.

In addition to the underwritten public offering we completed on February 18, 2020 resulting in the issuance of 1,955,000 additional shares of our common stock, and the currently-active at-the-market offering, we may offer additional shares of our common stock or other securities convertible into or exchangeable for our common stock in order to raise additional capital in the future. We cannot assure our shareholders that we will be able to sell shares or other securities in any other offering at a price per share that is equal to or greater than the price per share our shareholders paid for our shares. Investors purchasing shares or other securities in the future could have rights, preferences or privileges senior to those of our shareholders and our shareholders may experience dilution. Our shareholders may incur additional dilution upon the exercise of any outstanding stock options or warrants, the issuance of shares of restricted stock, the vesting of restricted stock units, or the issuance, vesting or exercise of other equity awards.

We do not intend to pay cash dividends in the foreseeable future and, consequently, our shareholders' ability to achieve a return on their investment will depend on appreciation in the price of our common stock.

We have never declared or paid cash dividends on our common stock and we do not intend to pay any cash dividends on our common stock in the foreseeable future. We currently expect to retain all available funds and any future earnings for use in the operation and expansion of our business. In addition, the terms of our revolving credit facility restrict our ability to pay dividends and any future credit facilities, loan agreements, debt instruments or other agreements may further restrict our ability to pay dividends. Payments of future dividends, if any, will be at the discretion of our board of directors after taking into account various factors, including our business, results of operations and financial condition, current and anticipated cash needs, plans for expansion and any legal or contractual limitations on our ability to pay dividends. As a result, capital appreciation, if any, of our common stock will be our shareholders' sole source of potential gain for the foreseeable future.

CAUTIONARY STATEMENT REGARDING FORWARD-LOOKING STATEMENTS

This report includes forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, or the Securities Act, and Section 21E of the Exchange Act that relate to future events or our future financial performance and involve known and unknown risks, uncertainties and other factors that may cause our actual results, levels of activity, performance or achievements to differ materially from any future results, levels of activity, performance or achievements expressed or implied by these forward-looking statements. Words such as, but not limited to, "believe," "expect," "anticipate," "estimate," "intend," "seek," "may," "plan," "potential," "predict," "project," "targets," "likely," "will," "would," "could," "should," "continue," and similar expressions or phrases, or the negative of those expressions or phrases, are intended to identify forward-looking statements, although not all forward-looking statements contain these identifying words. Although we believe that we have a reasonable basis for each forward-looking statement contained in this report, we caution you that these statements are based on our projections of the future that are subject to known and unknown risks and uncertainties and other factors that may cause our actual results, level of activity, performance or achievements expressed or implied by these forward-looking statements, to differ. The description of our Business set forth in Item 1, the Risk Factors set forth in this Item 1A and our Management's Discussion and Analysis of Financial Condition and Results of Operations set forth in Item 7 as well as other sections in this report, discuss some of the factors that could contribute to these differences. These forward-looking statements include, among other things, statements about:

- the expected future growth of the market for our aerogel products and our continued gain in market share, in particular in the energy infrastructure insulation market, the lithium-ion battery thermal barrier markets, and other markets we target;
- our beliefs about the competitive strengths and value propositions of our technology and our products and our ability to gain additional market share and enter into new markets based on those strengths;
- our expectation that our investment in incremental manufacturing and operating expense will sustain long-term growth in our existing markets and develop new business opportunities;
- our plans to continue to develop and optimize aerogel products for high-value applications within the building materials market and our plan to realize revenue from this market;
- our plans to develop and optimize aerogel products for potential commercialization within the electric vehicle market, including (i) our program to
 optimize carbon aerogels to improve the performance and cost of lithium-ion batteries and (ii) our initiative to develop and commercialize aerogel-based
 thermal barriers to inhibit the propagation of thermal runaway in electric vehicles and other systems using lithium-ion batteries;
- our plans and expectations to partner with industry leaders in the battery and electric vehicle market or such partnerships resulting in products and technologies or otherwise resulting in meaningful financial results;

- our expectations about the size and timing of future revenues and profit margins, arising from our supply relationship and contract with the major U.S. automotive original equipment manufacturer;
- our pursuit of high-value opportunities for our aerogel products within different segments of the global insulation market, including the building materials market, and our plans to leverage our aerogel technology platform to develop innovative, aerogel enhanced products for applications in new markets, including the electric vehicle market;
- our plans to focus additional resources to continue to grow our share of the energy infrastructure insulation market;
- our pursuit of and the expected greater adoption of our products in the LNG and power generation markets and our expectation that product revenue will be generated in large part by demand for insulation associated with scheduled plant shutdowns, or turnarounds, and other maintenance-related projects;
- our expectation that our products will be specified during the design phase in a growing number of new plant construction and capital expansion projects and our expectation that we will have an increasing percentage of our products sold for use in capital projects;
- our expectation that the growth in global energy demand will result in increased new-build and large capacity expansion projects, driving demand for our aerogel products;
- our plans to continue our strategy of working with innovative companies to target and penetrate additional market opportunities;
- our plans to develop strategic partnerships to facilitate market penetration beyond the energy infrastructure and building materials market, as well as the expected goals and priorities of such strategic partnerships;
- our belief that an adequate long-term supply of silica-precursors is available and that our plans to reduce reliance on precursors susceptible to significant price fluctuations will be successful;
- Our belief that we can strategically increase our capacity to meet the demand or that we will be able to make such capacity increases in a timely manner;
- our expectation in our ability to implement lower cost product formulations and realize material purchasing efficiencies;
- our belief that our portfolio of patents, trade secrets and know-how present a significant barrier to potential new entrants in the production of aerogel blanket insulation;
- our expectation that we will be successful in enforcing and defending our patents against competitors and that such patents are valid and enforceable, as well as our expectations about the costs and consequences of our current or potential future patent litigation and the potential for additional patent litigation:
- our belief that our products possess strong competitive advantages over traditional insulation materials, including the superior thermal performance and the thin, easy-to-use and durable blanket form of our products;
- our plans to expand capacity at our East Providence, Rhode Island manufacturing facility;
- our expectation that expanded capacity in our East Providence, Rhode Island facility will become available or operational in a timely manner to support the long-term growth in demand we expect;
- our expectation that the completion of the project to expand capacity in our East Providence, Rhode Island facility will provide an additional annual nameplate capacity of 5 million square feet of aerogel blankets;
- our belief that we can finance the expansion of our existing manufacturing facility with anticipated available credit, cash flows from operations, debt financings, technology licensing agreements, customer prepayments or equity financings;
- our belief that our end-use customers will continue to invest in major energy infrastructure projects;
- our expectation that we will continue to sell our products in the building materials and other end markets;
- our expectation that we will develop, manufacture and sell new products and technologies through the strategic partnership with BASF SE and that our strategic partnership with BASF SE will facilitate our penetration of the building materials market;
- our joint development agreement with BASF SE, and the potential for it to support the development and commercialization of new aerogel products and technologies;
- our expectations that our work with partners, including with SKC Co., Ltd. or Evonik Industries AG will accelerate the potential commercialization of these carbon aerogel anode materials in the electric vehicle market;

- our belief that the potential for significant technological innovation in traditional insulation materials is limited and that new high-performance materials will be required to meet evolving market requirements for energy efficient insulations systems;
- our belief that our aerogel products and manufacturing processes are proprietary and that we can protect our patents, trade secrets and know-how associated therewith;
- our belief that we can continue to improve the cost efficiency of our manufacturing process, that our current expansion plans offer attractive returns on incremental invested capital, and that we will focus our development efforts on new products and next generation technology with application in new, high value market segments;
- our belief that we will have opportunities to address additional high value applications in the estimated \$3.1 billion global insulation market, and that we are well positioned to leverage a decade's worth of research and development to design and commercialize disruptive aerogel products for a wide array of new markets;
- our belief that our products have the lowest cost on a fully-installed basis or offer significant life-cycle cost savings in energy infrastructure and certain other applications as compared to traditional insulation materials;
- our plans to continue to expand our global sales force and distribution network to support anticipated growth in customers and demand for our products and our plans to seek to promote greater enterprise-wide utilization of our products by existing end-use customers;
- our belief that revenue growth will moderate due to a decrease in project-based demand in the subsea market and little to no growth in project-based demand in the LNG market;
- our expectations and projections about future revenues, revenue growth, costs, expenses, production volumes, manufacturing productivity, gross profit, profitability, net loss, loss per share and Adjusted EBITDA, sources and uses of cash, liquidity, cash flow, capital requirements and the sufficiency of our existing cash balance and available credit;
- our expectations that most of our revenue will continue to come from a relatively small number of customers for the foreseeable future;
- our expectations of long-term revenue growth, with increasing levels of gross profit and improved cash flows from operations and our expectations that we will incur significant capital expenditures related to the expansion of our manufacturing capacity to support this expected long-term growth in demand:
- our expectations that the operating expenses will increase in both absolute dollars and as a percentage of revenue in 2021 but increase in absolute dollars and decrease as a percentage of revenue in the longer term, our research and development expenses will increase in both absolute dollars and as a percentage of revenue in 2021 but increase in absolute dollars and decrease as a percentage of revenue in the longer term, our sales and marketing expenses will increase in both absolute dollars and as a percentage of revenue in 2020 but increase in absolute dollars and decrease as a percentage of revenue in the longer term, and our general and administrative expenses will increase in both absolute dollars and as a percentage of revenue in 2021 but increase in absolute dollars and decrease as a percentage of revenue in the longer term;
- our expectation to continue to increase investment in research and development in our efforts to enhance and expand our aerogel technology platform;
- our expectations about the impact of new accounting pronouncements on our consolidated financial statements and related disclosures;
- our belief that our experienced and dedicated leadership team will provide us with a competitive advantage in the industry;
- our belief of our technological and market leadership in aerogels;
- the expected future development of new aerogel technologies; and
- our expectations about limitations of net operating losses.

We may not actually achieve the plans, intentions or expectations disclosed in our forward-looking statements, and you should not place undue reliance on our forward-looking statements. Actual results or events could differ materially from the plans, intentions and expectations disclosed in the forward-looking statements we make. We have included important cautionary statements in this report, particularly in the Risk Factors set forth in Item 1A of this Annual Report on Form 10-K, that we believe could cause actual results or events to differ materially from the forward-looking statements that we make. Our forward-looking statements do not reflect the potential impact of any future acquisitions, mergers, dispositions, joint ventures or investments we may make.

You should read this report and the documents that we reference in this report and have filed as exhibits to this report completely and with the understanding that our actual future results may be materially different from what we expect. The forward-looking statements contained in this report are made as of the date of this report, and we do not assume, and specifically disclaim, any obligation to update any forward-looking statements, whether as a result of new information, future events or otherwise.

Item 1B. UNRESOLVED STAFF COMMENTS

None.

Item 2. PROPERTIES

Our corporate headquarters are located in Northborough, Massachusetts, where we occupy approximately 51,650 square feet under a lease expiring on December 31, 2026. We also own an approximately 143,000 square foot manufacturing facility in East Providence, Rhode Island. In addition, we lease a 10,500 square foot facility, a 24,000 square foot facility and a 128,000 square foot facility in East Providence, Rhode Island, which leases expire on March 31, 2021, March 31, 2021 and March 31, 2024, respectively.

Item 3. LEGAL PROCEEDINGS

Patent Enforcement Actions

In May 2016, we filed a complaint for patent infringement against Nano Tech Co., Ltd. (Nano), and Guangdong Alison Hi Tech., Ltd. (Alison) in the International Trade Commission, or ITC. In February 2018, the ITC issued its final determination that Nano and Alison had infringed asserted Aspen patents and that they have not proven the patents are invalid except with respect to one dependent product claim, which the ITC found was not infringed. The ITC affirmed that Alison and Nano each violated Section 337 of the Tariff Act and issued a limited exclusion order prohibiting importation of infringing aerogel insulation products manufactured by Alison and Nano. Alison's appeal with respect to a product patent to the United States Court of Appeals for the Federal Circuit (CAFC) was rejected, and resulted in CAFC affirming the validity of our patent. The exclusion order, which is enforced by the United States Customs and Border Protection, is currently in effect.

Additionally, the USPTO denied Alison's requests to invalidate the claims of four of our patents in Inter-Partes Review. Alison also filed multiple similar requests with the Chinese Patent Office (SIPO), seeking to invalidate our Chinese manufacturing process patents and two of our Chinese product patents. With respect to one of those requests, not withdrawn previously by Alison, the Patent Review Board of SIPO (PRB), issued a decision upholding the validity of Aspen's issued patent as amended in the proceedings. Alison has appealed the PRB's decision to the Beijing IP court. On July 25, 2020, the Beijing IP court dismissed Alison's appeal and upheld the validity of Aspen's patent and we received this decision on September 15, 2020. Nano has also filed a request seeking invalidation of a product patent at SIPO. After the oral hearing at PRB, Nano withdrew its invalidation request. On September 23, 2019, Alison filed yet another request to invalidate the same patent, whose validity was previously confirmed by PRB. On January 23, 2020 PRB denied Alison's latest invalidation request.

In April 2016, we also filed a patent infringement suit at the District Court in Mannheim, Germany (Mannheim court), against Nano, Alison and two European resellers asserting their infringement of one of our German patents. We subsequently asserted infringement of another three patents against Nano, Alison and a European reseller of Alison's products at the Mannheim court. We have since settled with one European reseller in exchange for a commitment not to procure infringing products and cooperation with our case.

- In January 2018, the court issued a series of judgments by acknowledgement (German, "Anerkenntnisurteil") finding the second reseller, Hiltex, liable for infringement and also issued injunctions against Hiltex. The judgments resulted from a settlement agreement in which Hiltex agreed not to resell the infringing products in Europe where at least one of the asserted patents are active.
- On March 8, 2019, the Mannheim court issued two separate judgments in cases against Nano and Alison, respectively. The Mannheim court determined that both Nano and Alison are infringing on Aspen's EP1638750 (750 Patent) in connection with their respective products. The court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing the infringing products. The court found the defendants liable to us for damages since September 22, 2012. The court also ordered the defendants to provide information on the scope of the acts of infringement committed since August 22, 2012, and a recall of infringing products. The court ordered Nano and Alison to bear the costs of the legal proceedings and reimburse statutory attorneys' costs and expenses to us, that exact amount of which is yet to be determined. Nano and Alison have appealed the judgments of the Mannheim court. Nano subsequently withdrew the appeal while Alison's appeal is currently pending.

- The Mannheim court issued two decisions on December 23, 2019 finding that Alison infringed the 577 Patent and the 950 Patent and also issued injunctions prohibiting Alison from continuing infringement in connection with any aerogel sheets. The December 2019 decisions against Alison have now become final and binding.
- The Mannheim court issued two decisions on July 31, 2020 finding that Nano infringed each of the 577 Patent and the 950 Patent. In addition to granting other remedies, the court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing any aerogel sheets. After the passing of deadline to file appeals, these decisions have now become final.
- Nano and Alison also initiated nullity actions in German Federal Patent Court in Munich against our asserted German patents. On September 25, 2018, the Federal Patent Court in Munich dismissed the challenge to the validity of 750 Patent which has subsequently become final. Nano and Alison also filed an opposition to one of the asserted patents at the EPO. In December 2018, the opposition division of EPO determined the patent, EP2813338 (338 Patent), was invalid on formality grounds and decided to revoke it, which determination is currently under appeal at the EPO Board of appeals.
- On March 19 and 20, 2019 the German Federal Patent Court in Munich (FPC) conducted oral proceedings and voided four claims in EP2415577 (577 Patent) and confirmed the validity of challenged claims in EP2422950 (950 Patent) within the scope of silica gels. These FPC judgments are now final and binding on the parties. Nano had filed another nullity action seeking to invalidate the remaining claims in the 577 Patent which action Nano subsequently failed to pursue. On June 17, 2020, Nano also filed an opposition to a recently issued Aspen Patent EP3120983B1, titled "Continuous Sheet of Gel Materials and Continuous sheet of Aerogel".

Additionally, a reseller of Nano's products in Taiwan challenged the validity of one of our patents in Taiwan in 2018. After careful review of our written response, the Taiwanese patent office has determined the patent as valid and dismissed the challenge in December 2018. In 2018, LG Chem Ltd. challenged the validity of one of our patents in Korea at the IPTAB of the Korean Intellectual Property Office. After conducting an oral hearing, the IPTAB issued a decision on November 30, 2019 upholding claims related to aerogel sheets incorporating fibers. On January 14, 2021 the Korean Patent Court confirmed the validity of the claims related to aerogel sheets incorporating fibers.

Due to their nature, it is difficult to predict the outcome or the costs involved in any litigation or administrative proceedings, including any appeals process. Furthermore, the counter parties in these proceedings may have significant resources and interest to litigate and therefore, these litigation matters could be protracted and may ultimately involve significant legal expenses. In addition to the foregoing, we have been and may be from time to time a party to other legal proceedings that arise in the ordinary course of business and to other patent enforcement actions to assert our patent rights.

Brazilian Enforcement Action

In August 2018, we filed an enforcement suit against Qualiman Engenharia E Montagens LTDA, or Qualiman, one of our South American customers, in civil court in Sao Paulo, Brazil seeking payment of past due invoices totaling approximately \$2.9 million. In October 2018, the Brazilian court ruled in our favor with respect to Qualiman's obligation to pay us immediately. As part of the remedy, the Court ordered Qualiman's customer, Petroleo Brasilero S.A., or Petrobras, to redirect part of its payments to Qualiman to a court-administered bank account and other appropriate actions. Subsequently, we learned that Qualiman has laid off a substantial portion of its installers and threatened to walk away from Petrobras' contract. In connection with such layoffs, a Brazilian labor court is addressing reparations to laid-off workers. We learned that Petrobras and Qualiman are seeking to renegotiate the contract between them in connection with this project. On February 26, 2019, an appeals court dismissed Qualiman's appeal of the decision of the Sao Paulo civil court on the merits. Subsequent to this ruling, we recovered \$0.3 million through these court actions. Additional recovery of remaining unpaid accounts receivable is unlikely due to Qualiman's filing of judicial reorganization under Brazilian laws and its consequences on our recovery action.

Item 4. MINE SAFETY DISCLOSURES

Not applicable.

PART II

Item 5. MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES

Market Information and Dividend Policy

Our common stock is trading on The New York Stock Exchange, or NYSE, under the symbol "ASPN." As of March 9, 2021, there were approximately 27 stockholders of record of our common stock.

Dividends

We have not paid dividends to our stockholders since our inception and we do not plan to pay cash dividends in the foreseeable future. We currently intend to retain earnings, if any, to finance the development and expansion of our business.

Unregistered Sales of Equity Securities and Use of Proceeds

- (a) Unregistered Sales of Equity Securities. Not applicable.
- (b) Use of Proceeds from Initial Public Offering of Common Stock. Not applicable.
- (c) Purchases of Equity Securities By the Issuer and Affiliated Purchasers. We did not repurchase any of our equity securities during the year ended December 31, 2020.

Item 6. SELECTED FINANCIAL DATA

The following table sets forth our selected consolidated financial data for the periods, and as of the dates, indicated. You should read the following selected consolidated financial data in conjunction with our consolidated financial statements and the related notes thereto included elsewhere in this Annual Report on Form 10-K and the "Management's Discussion and Analysis of Financial Condition and Results of Operations" section of this Annual Report on Form 10-K.

We derived the consolidated statement of operations data for the years ended December 31, 2020, 2019 and 2018, and the consolidated balance sheet data as of December 31, 2020 and 2019, from our audited consolidated financial statements and the related notes thereto included elsewhere in this Annual Report, which financial statements have been audited by KPMG LLP, independent registered public accounting firm. We derived the consolidated statement of operations data for the fiscal years ended December 31, 2017 and 2016, and the consolidated balance sheet data as of December 31, 2018, 2017 and 2016, from our audited consolidated financial statements and the related notes thereto that are not included in this Annual Report, which financial statements have been audited by KPMG LLP, independent registered public accounting firm.

				Ye	ar End	ed December	31,			
	_	2020		2019		2018		2017		2016
				(\$ in thousand	ls, exce	pt share and p	per s	hare data)		
Consolidated statements of operations data:										
Revenue:	Ф	00.024	Ф	126.024	Ф	100 100	Φ	100 500	Φ	115 400
Product Research services	\$)	\$	136,934	\$	102,123	\$	109,590	\$	115,490
	<u> </u>	439	_	2,441		2,238	_	2,041	_	2,248
Total revenue		100,273		139,375		104,361		111,631		117,738
Cost of revenue: Product		05 515		111.750		00.660		02.052		02 122
Research services		85,545		111,759		90,660		92,052		93,123
	<u> </u>	134	_	1,332	_	1,032	_	908	_	1,304
Gross profit		14,594		26,284		12,669		18,671		23,311
Operating expenses:		0.720		0.407		(210		C 100		5.20C
Research and development		8,729		8,407		6,319		6,180		5,306
Sales and marketing General and administrative		11,753		15,557		13,794		12,604		11,810
		15,681		16,479		19,116		19,023		17,415
Impairment of construction in progress	<u> </u>	26.162	_	40.442	_	7,356	_	27.007	_	24.521
Total operating expenses	<u> </u>	36,163	_	40,443		46,585	_	37,807	_	34,531
Loss from operations		(21,569)		(14,159)		(33,916)		(19,136)		(11,220)
Other expense, net:		(2.10)		(406)		(50.4)		(105)		(1.45)
Interest expense, net		(240)		(406)		(524)		(185)		(147)
Postponed financing costs	<u> </u>		_				_			(656)
Total other expense, net	_	(240)	_	(406)		(524)	_	(185)	_	(803)
Net loss	<u>_</u>	(21,809)	_	(14,565)		(34,440)	_	(19,321)	_	(12,023)
Per share data:										
Net loss per share:										
Basic and diluted	\$	(0.83)	\$	(0.60)	\$	(1.45)	\$	(0.83)	\$	(0.52)
Weighted-average common shares outstanding:	=		_				_			
Basic and diluted		26,377,652		24,099,438	2	23,738,852		23,390,235		23,139,807
	=		_				_		_	
					As of l	December 31,				
	_	2020		2019	115 01 1	2018		2017		2016
Consolidated balance sheet data:										
Cash and cash equivalents	\$	16,496	\$	3,633	\$	3,327	\$	10,694	\$	18,086
Working capital (1)		33,196		15,335		14,185		26,093		32,056
Total assets		97,424		103,502		99,023		123,815		134,669
Total debt		3,668		3,123		4,181		3,750		39

⁽¹⁾ Working capital is our current assets less our current liabilities.

Total stockholders' equity

67,852

58,990

70,254

100,943

115,564

Item 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

The following discussion of our financial condition and results of operations should be read in conjunction with the "Selected Financial Data" and our consolidated financial statements and the related notes thereto included in this Annual Report on Form 10-K. In addition to historical information, some of the information contained in the following discussion and analysis or set forth elsewhere in this report, including information with respect to our plans and strategy for our business, includes forward looking information that involves risks, uncertainties and assumptions. You should read the Risk Factors set forth in Item 1A of this Annual Report on Form 10-K for a discussion of important factors that could cause actual results to differ materially from the results described in or implied by the forward-looking statements contained in the following discussion and analysis. Our actual results and the timing of events could differ materially from those anticipated by these forward looking statements.

Investors and others should note that we routinely use the Investors section of our website to announce material information to investors and the marketplace. While not all of the information that we post on the Investors section of our website is of a material nature, some information could be deemed to be material. Accordingly, we encourage investors, the media, and others interested in us to review the information that we share on the Investors section of our website, https://www.aerogel.com/.

Overview

We design, develop and manufacture innovative, high-performance aerogel insulation used primarily in the energy infrastructure and building materials markets. We believe our aerogel blankets deliver the best thermal performance of any widely used insulation product available on the market today and provide a combination of performance attributes unmatched by traditional insulation materials. Our end-use customers select our products where thermal performance is critical and to save money, improve resource efficiency, enhance sustainability, preserve operating assets and protect workers. Our insulation is used by oil producers and the owners and operators of refineries, petrochemical plants, liquefied natural gas facilities, power generating assets and other energy infrastructure. Our Pyrogel and Cryogel product lines have undergone rigorous technical validation by industry leading end-users and achieved significant market adoption.

We are also actively developing a number of promising aerogel products and technologies for the electric vehicle market. We have developed and are commercializing our proprietary line of PyroThin aerogel thermal barriers, for use in lithium-ion batteries in electric vehicles. Our PyroThin product is an ultra-thin, lightweight and flexible thermal barrier designed to impede the propagation of thermal runaway across multiple lithium-ion battery system architectures. Our thermal barrier technology offers a unique combination of performance attributes that enable electric vehicle manufacturers to achieve critical safety goals without sacrificing driving range. In addition, we are seeking to leverage our patented carbon aerogel technology to develop industry-leading battery materials for lithium-ion battery systems. These battery materials have the potential to enable an increase in the drive range of electric vehicles.

The commercial potential for the our PyroThin thermal barriers and our carbon aerogel battery materials in the electric vehicle market is significant and is likely to require us to hire additional personnel, incur additional operating expenses, and incur capital expenditures to expand manufacturing capacity, build an automated fabrication operation, and meet automotive quality system requirements, among other items.

We also derive product revenue from a number of other end markets, including the building materials market. Customers in these markets use our products for applications as diverse as wall systems, military and commercial aircraft, trains, buses, appliances, apparel, footwear and outdoor gear. As we continue to enhance our aerogel technology platform, we believe we will have additional opportunities to address high value applications in the global insulation market, the electric vehicle market and in a number of new, high-value markets.

We generate product revenue through the sale of our line of aerogel blankets and thermal barriers. We market and sell our products primarily through a sales force based in North America, Europe and Asia. The efforts of our sales force are supported by a small number of sales consultants with extensive knowledge of a particular market or region. Our sales force is responsible for establishing and maintaining customer and partner relationships, delivering highly technical information and ensuring high-quality customer service.

Our salespeople work directly with end-use customers and engineering firms to promote the qualification, specification and acceptance of our products. We also rely on an existing and well-established channel of qualified insulation distributors and contractors in more than 50 countries around the world to ensure rapid delivery of our products and strong end-user support. Our salespeople also work to educate insulation contractors about the technical and operating cost advantages of our aerogel blankets.

We also perform research services under contracts with various agencies of the U.S. government, including the Department of Defense and the Department of Energy, and other institutions. We decided to cease efforts to secure additional funded research contracts and to wind down our existing contract research activities. This decision reflected our desire to focus our research and development resources on initiatives to improve the profitability of our existing business and on efforts to develop new products and next generation technology with application in new, high value markets.

We manufacture our products using our proprietary technology at our facility in East Providence, Rhode Island. We have operated the East Providence facility since 2008 and have increased our annual capacity in phases through December 31, 2020 to 55 million square feet of aerogel blankets. We are currently engaged in an initiative, which we refer to as EP20, designed to increase the capacity of the East Providence facility to 60 million square feet of aerogel blankets by the end of 2021. In addition, we anticipate that we will need to construct a state-of-the-art thermal barrier fabrication operation, hire dedicated thermal barrier fabrication employees, and increase our aerogel blanket manufacturing capacity to keep pace with the significant potential demand for our PyroThin thermal barriers. Accordingly, we are in the early stages of planning a significant expansion of our aerogel capacity prior to the end of 2023. The expected elements of the completed expansion plan will include the size of the required capacity expansion, the selection of an optimal manufacturing site for the expansion, the appropriate financing structure to fund the project fully and a detailed timeline for the construction and operation of the facility.

We had previously completed the design and engineering for a second manufacturing facility to be located in Statesboro, Georgia. During 2016, we elected to delay construction of the facility due to our assessment of future demand. In December 2018, we determined that we will not use the existing design and engineering to construct a second facility in any location. Accordingly, we determined that the design and engineering costs were not recoverable and recorded an impairment charge of \$7.4 million on construction in progress assets during 2018.

On September 17, 2020, we entered into a contract with a major U.S. automotive original equipment manufacturer to supply fabricated, multi-part thermal barriers for use in the battery system of its next-generation electric vehicles. Pursuant to the contract, we are obligated to supply the barriers at fixed annual prices and at volumes to be specified by the customer up to a daily maximum quantity through the term of the agreement, which expires on September 1, 2026. While the customer has agreed to purchase its requirement for the barriers at locations to be designated from time to time from us, it has no obligation to purchase any minimum quantity of barriers under the contract. In addition, the customer may terminate the contract any time and for any or no reason. All other terms of the contract are generally consistent with the customer's standard purchase terms, including customary quality and warranty provisions.

We are engaged in a strategic partnership with BASF to develop and commercialize products for the building materials and other markets. The strategic partnership includes a supply agreement governing the exclusive sale of specified products to BASF and a joint development agreement targeting innovative products and technologies. BASF has no obligation to purchase any products under the supply agreement. Pursuant to the supply agreement, BASF may, in its sole discretion, make prepayments to us in the aggregate amount of up to \$22.0 million during the term of the agreement. We may repay the prepayments to BASF at any time in whole or in part for any reason.

BASF made a prepayment to us of \$5.0 million during 2018. As of January 1, 2019, 25.3% of any amounts that we invoice for Spaceloft A2 sold to BASF will be credited against the outstanding balance of the 2018 prepayment. If any amount of the 2018 prepayment remains uncredited at December 31, 2021, BASF may require that we repay the uncredited amount following a six-week notice period. In January 2019, BASF made an additional prepayment to us of \$5.0 million. As of January 1, 2020, 50% of any amounts that we invoice for a newly developed product sold to BASF will be credited against the outstanding balance of the 2019 prepayment. After December 31, 2022, BASF may require that we credit 24.7% of any amounts we invoice for Spaceloft A2 sold to BASF against the outstanding balance of the 2019 prepayment or may require that we repay the uncredited amount to BASF following a six-week notice period.

On February 18, 2020, we completed an underwritten public offering of 1,955,000 shares of our common stock at an offering price of \$8.25 per share. We received net proceeds of \$14.8 million after deducting underwriting discounts and commissions of \$1.1 million and offering expenses of approximately \$0.3 million.

On November 5, 2020, we entered into a sales agreement with B. Riley Securities, Inc. ("B. Riley Securities") with respect to an at-the-market ("ATM") offering program under which we may offer and sell, from time to time in our sole discretion, shares of our common stock, through B. Riley Securities as our sales agent. During November and December 2020, we completed the sale of 714,357 shares at an average price of \$13.96 per share through our at-the-market offering and received net proceeds of \$9.5 million after deducting commissions of \$0.3 million and offering expenses of approximately \$0.2 million.

On March 3, 2020, we amended our revolving credit facility with Silicon Valley Bank to extend the maturity date of the facility to April 28, 2021 and establish certain minimum levels for the minimum Adjusted EBITDA financial covenant for the extended term.

We further amended our revolving credit facility with Silicon Valley Bank to revise the minimum Adjusted EBITDA financial covenant on September 25 2020 and to secure a preemptive waiver of the Adjusted EBITDA financial covenant on December 24, 2020, among other things. On March 12, 2021, we amended and restated our revolving credit facility with Silicon Valley Bank to extend the maturity date of the revolving credit facility to April 28, 2022 and to establish certain minimum Adjusted EBITDA levels with respect to the minimum Adjusted EBITDA and minimum Adjusted Quick Ratio covenants, as defined. Under our revolving credit facility, we are permitted to borrow a maximum of \$20.0 million, subject to continued covenant compliance and borrowing base requirements. The interest rate applicable to borrowings under the revolving credit facility is based on the prime rate, subject to a minimum rate of 4.00% per annum. Prime rate-based rates vary from prime rate plus 0.75% per annum to prime rate plus 2.00% per annum. In addition, we are required to pay a monthly unused revolving line of credit facility fee of 0.50% per annum of the average unused portion of the revolving credit facility. We intend to extend or replace the facility prior to its maturity.

On May 1, 2020, our wholly-owned subsidiary, Aspen Aerogels Rhode Island, LLC (Borrower), executed a note for an unsecured loan of \$3.7 million pursuant to the Paycheck Protection Program (PPP Loan) under the Coronavirus Aid, Relief, and Economic Security Act (CARES Act), as amended, and administered by the U.S. Small Business Administration (SBA). The Borrower conferred with representatives of the SBA prior to finalizing the PPP Loan. The loan is unsecured, contains customary events of default, carries an interest rate of 1% per year, and matures on May 1, 2022. The Borrower may repay the loan at any time without penalty. In addition, the Borrower is permitted at any time to submit an application to extend the maturity of loan to May 1, 2025.

The Borrower may also choose to apply to have the PPP Loan forgiven in whole or in part subject to SBA guidelines. The potential amount of forgiveness is based on the Borrower's use of loan proceeds for payroll costs, mortgage interest payments, rent and utility costs over either an eight-week or 24-week period following receipt of the loan proceeds. The SBA may disapprove of the loan forgiveness application if the agency determines that the Borrower was ineligible for the PPP Loan. As of December 31, 2020, the Borrower had not applied for forgiveness.

Upon application, the Borrower may receive loan forgiveness in whole or in part. In addition, the amount of potential loan forgiveness will be reduced if the Borrower failed to maintain employee and salary levels during the applicable eight-week or 24-week period following receipt of the loan proceeds. If the Borrower applies for forgiveness, and the PPP Loan is not forgiven in whole or in part, the Borrower will be required to begin to make payments of the principal and accrued interest of the post-forgiveness balance outstanding in equal monthly installments over the remaining term of the loan. If the Borrower does not apply for forgiveness by August 19, 2021, the Borrower will be required to make payments of principal and accrued interest in equal monthly installments over the remaining term of the loan.

The Borrower used the proceeds of the PPP Loan to support ongoing operations and to sustain staffing levels in the East Providence, Rhode Island manufacturing facility despite the unfavorable impact the COVID-19 pandemic and volatile energy markets had on its business.

In response to the COVID-19 pandemic, we have implemented and are following safe practices recommended by public health authorities and other government entities. We continue to focus on the safety and health of our employees, customers and vendors. In addition, we have implemented various precautionary measures, including remote work arrangements, restricted business travel and procedures for social distancing, face coverings and safe hygiene. We continue to monitor public health guidance as it evolves and plan to adapt our practices as appropriate. Refer to the section below entitled "Item 1A. Risk Factors" for more information concerning risks to our business associated with COVID-19.

At present, we are not certain of the extent of the impact that the COVID-19 pandemic and global oil market volatility may have on our business. Our manufacturing facility remains operational and we have not encountered any significant disruption to our supply chain or our ability to deliver to our customers. However, the demand for our products has been negatively impacted, particularly due to access restrictions on contractors in energy infrastructure facilities, resulting in a significant year-over-year decrease in our total revenue and increase in our net loss.

In response to this general uncertainty in the market for our products, we implemented a number of actions in 2020 to reduce expenses, including wage reductions, temporary suspension of board fees and selected reductions to discretionary expenses. In addition, as permitted by the CARES Act, we elected to defer certain payments of the employer share of Social Security tax that would otherwise be required to be paid during the period beginning on March 27, 2020 and ending December 31, 2020. We also remain prepared to temporarily curtail operations in our East Providence, Rhode Island manufacturing facility as necessary to ensure the safety of our employees or to align capacity with the expected lower demand.

Our revenue for the year ended December 31, 2020 was \$100.3 million, which represented a decrease of \$39.1 million, or 28%, from the year ended December 31, 2019. Net loss for the year ended December 31, 2020 was \$21.8 million and net loss per share was \$0.83. Net loss for the year ended December 31, 2019 was \$14.6 million and net loss per share was \$0.60.

Key Metrics and Non-GAAP Financial Measures

We regularly review a number of metrics, including the following key metrics, to evaluate our business, measure our performance, identify trends affecting our business, formulate financial projections and make strategic decisions.

Square Foot Operating Metric

We price our product and measure our product shipments in square feet. We estimate our annual capacity was 55 million square feet of aerogel blankets at December 31, 2020. We believe the square foot operating metric allows us and our investors to measure our manufacturing capacity and product shipments on a uniform and consistent basis. The following chart sets forth product shipments in square feet associated with recognized revenue, including revenue recognized over time utilizing the input method, for the periods presented:

_	Year	Ended December 31,	
	2020	2019	2018
	(Squ	are feet in thousands)	
	28,635	40,720	34,435

Product shipments in square feet

Adjusted EBITDA

We use Adjusted EBITDA, a non-GAAP financial measure, as a means to assess our operating performance. We define Adjusted EBITDA as net income (loss) before interest expense, taxes, depreciation, amortization, stock-based compensation expense and other items, from time to time, which we do not believe are indicative of our core operating performance, which in 2018 included an impairment of construction in progress. Adjusted EBITDA is a supplemental measure of our performance that is not presented in accordance with U.S. GAAP. Adjusted EBITDA should not be considered as an alternative to net income (loss) or any other measure of financial performance calculated and presented in accordance with U.S. GAAP. In addition, our definition and presentation of Adjusted EBITDA may not be comparable to similarly titled measures presented by other companies.

We use Adjusted EBITDA:

- as a measure of operating performance because it does not include the impact of items that we do not consider indicative of our core operating performance;
- for planning purposes, including the preparation of our annual operating budget;
- to allocate resources to enhance the financial performance of our business; and
- as a performance measure used under our bonus plan.

We also believe that the presentation of Adjusted EBITDA provides useful information to investors with respect to our results of operations and in assessing the performance and value of our business. Various measures of EBITDA are widely used by investors to measure a company's operating performance without regard to items that can vary substantially from company to company depending upon financing and accounting methods, book values of assets, capital structures and the methods by which assets were acquired.

Although measures similar to Adjusted EBITDA are frequently used by investors and securities analysts in their evaluation of companies, we understand that Adjusted EBITDA has limitations as an analytical tool, and you should not consider it in isolation or as a substitute for net income (loss), income (loss) from operations, net cash provided by (used in) operating activities or an analysis of our results of operations as reported under U.S. GAAP. Some of these limitations are:

- Adjusted EBITDA does not reflect our historical cash expenditures or future requirements for capital expenditures or other contractual commitments;
- Adjusted EBITDA does not reflect changes in, or cash requirements for, our working capital needs;
- Adjusted EBITDA does not reflect stock-based compensation expense;
- Adjusted EBITDA does not reflect our tax expense or cash requirements to pay our income taxes;
- Adjusted EBITDA does not reflect our interest expense, or the cash requirements necessary to service interest or principal payments on our debt;

- although depreciation, amortization and impairment charges are non-cash charges, the assets being depreciated, amortized or impaired will often have to be replaced in the future, and Adjusted EBITDA does not reflect any cash requirements for these replacements; and
- other companies in our industry may calculate EBITDA or Adjusted EBITDA differently than we do, limiting their usefulness as a comparative measure.

Because of these limitations, our Adjusted EBITDA should not be considered as a measure of discretionary cash available to us to reinvest in the growth of our business or as a measure of cash available for us to meet our obligations.

To properly and prudently evaluate our business, we encourage you to review the U.S. GAAP financial statements included elsewhere in this Annual Report on Form 10-K, and not to rely on any single financial measure to evaluate our business.

The following table presents a reconciliation of net loss, the most directly comparable U.S. GAAP measure, to Adjusted EBITDA for the years presented:

	Year Ended December 31,							
		2020		2019		2018		
			(\$ i	n thousands)				
Net loss	\$	(21,809)	\$	(14,565)	\$	(34,440)		
Depreciation and amortization		10,198		10,213		10,787		
Impairment of construction in progress		_		_		7,356		
Stock-based compensation (1)		5,004		3,771		4,302		
Interest expense, net		240		406		524		
Adjusted EBITDA	\$	(6,367)	\$	(175)	\$	(11,471)		

(1) Represents non-cash stock-based compensation related to vesting and modifications of stock option grants, vesting of restricted stock units and vesting and modification of restricted common stock.

The following table presents a reconciliation of net loss, the most directly comparable U.S. GAAP measure, to Adjusted EBITDA for the quarters presented:

				Three Mon	ths E	nded						Three Mon	ths I	Ended			
	2020									2019							
	March 31 June 30 Sept. 30 Dec. 31						March 31 June 30			June 30	Sept. 30		Γ	Dec. 31			
								(\$ in thou	sand	s)							
Net loss	\$	(3,169)	\$	(5,698)	\$	(6,753)	\$	(6,189)	\$	(6,002)	\$	(5,318)	\$	(2,289)	\$	(956)	
Depreciation and amortization		2,563		2,562		2,545		2,528		2,532		2,565		2,554		2,562	
Stock-based compensation (1)		992		1,007		991		2,014		878		996		1,011		886	
Interest expense, net		83		50		49		58		41		103		136		126	
Adjusted EBITDA	\$	469	\$	(2,079)	\$	(3,168)	\$	(1,589)	\$	(2,551)	\$	(1,654)	\$	1,412	\$	2,618	

(1) Represents non-cash stock-based compensation related to vesting and modifications of stock option grants, vesting of restricted stock units and vesting and modification of restricted common stock.

Our financial performance, including such measures as net income (loss), earnings per share and Adjusted EBITDA, are affected by a number of factors including volume and mix of aerogel products sold, average selling prices, our material costs and manufacturing expenses, the costs associated with capacity expansions and start-up of additional production capacity, and the amount and timing of operating expenses. Accordingly, we expect that our net income (loss), earnings per share and Adjusted EBITDA will vary from period to period.

During 2020, we experienced a broad-based decrease in both project and maintenance based revenue in the global energy infrastructure business. The decline in demand was principally due to our energy infrastructure customers seeking to limit the number of third-party insulation installers in their facilities to reduce worker density, temporarily shuttering operations from time-to-time in response to COVID-19 outbreaks, and delaying the start of projects due to the threat of COVID-related interruptions. As a result, we experienced a total revenue decrease of 28%, an increase in net loss, and a decrease in Adjusted EBITDA during 2020 versus 2019.

During 2021, we expect that the COVID-19 pandemic will continue to constrain our revenue to 2020 levels with some potential for additional project-related revenue. When the effects of the COVID-19 pandemic recede, we anticipate that our revenue will

increase with the elimination of contractor access restrictions in energy infrastructure facilities and as our distribution channel restocks.

We expect that our ongoing initiatives to reduce raw material costs and enhance manufacturing productivity will help to improve our gross margin in 2021 as compared to 2020. However, we intend to increase our investment in the electric vehicle market and our aerogel technology platform by \$6.0 million in 2021. This investment will be used to accelerate thermal barrier business development, to establish industry-leading thermal barrier fabrication capability, to progress from the development phase to the commercialization phase of our silicon-rich carbon aerogel battery materials, and to identify additional high-value markets for our aerogel technology. As a result, we expect to experience a decrease in Adjusted EBITDA and an increase in net loss versus 2020.

Revenue

We recognize product revenue from the sale of our line of aerogel products and research services revenue from the provision of services under contracts with various agencies of the U.S. government and other institutions. Product and research services revenue is recognized upon the satisfaction of contractual performance obligations.

We record deferred revenue for product sales when (i) we have delivered products but other revenue recognition criteria have not been satisfied or (ii) payments have been received in advance of the completion of required performance obligations.

We have decided to cease efforts to secure additional research contracts and to wind down existing contract research activities.

The following table sets forth the total revenue for the periods presented:

		Ye	ear Enc	led December	31,			
	<u></u>	2020		2019		2018		
	(\$ in thousands)							
venue:								
Product	\$	99,834	\$	136,934	\$	102,123		
Research services		439		2,441		2,238		
Total revenue	\$	100,273	\$	139,375	\$	104,361		

Product revenue accounted for greater than 99% of total revenue for the year ended December 31, 2020 and 98% for both the years ended December 31, 2019 and 2018. We experienced a 28% decrease in total revenue during 2020 due to a broad-based decrease in both project and maintenance-based revenue in the global energy infrastructure market due the impact of the COVID-19 pandemic, partially offset by a modest increase in demand related to our building materials business. The COVID-19 related decrease in demand was the principally the result of contractor access restrictions in energy infrastructure facilities. We also experienced a decline in our research services revenue due to our decision to cease efforts to secure additional research contracts and to wind down existing contract research activities.

During 2021, we expect that the COVID-19 pandemic will continue to constrain our revenue to 2020 levels with some potential for project-related upside. When the effects of the COVID-19 pandemic recede, we anticipate that our revenue will increase with the elimination of contractor access restrictions in energy infrastructure facilities and as our distribution channel restocks.

A substantial majority of our revenue is generated from a limited number of direct customers, including distributors, contractors, fabricators, partners and enduse customers. Our 10 largest customers accounted for approximately 66% of our total revenue during the year ended December 31, 2020, and we expect that most of our revenue will continue to come from a relatively small number of customers for the foreseeable future.

In 2020, sales to Distribution International, Inc. and SPCC Joint Venture represented 21% and 15% our total revenue, respectively. In 2019, sales to Distribution International, Inc. and SPCC Joint Venture represented 20% and 13% our total revenue, respectively. In 2018, sales to Distribution International, Inc. represented 20% of our total revenue. For each of the noted periods, there were no other customers that represented 10% or more of our total revenues.

We conduct business across the globe and a substantial portion of our revenue is generated outside of the United States. Total revenue from outside of the United States, based on shipment destination, amounted to \$55.5 million, or 55% of our total revenue, \$81.0 million, or 58% of our total revenue, and \$62.6 million, or 60% of our total revenue, in the years ended December 31, 2020, 2019 and 2018, respectively.

Cost of Revenue

Cost of product revenue consists primarily of materials and manufacturing expense. Cost of product revenue is recorded when the related product revenue is recognized.

Material is our most significant component of cost of product revenue and includes fibrous batting, silica materials and additives. Material costs as a percentage of product revenue were 44%, 48% and 47% for the years ended December 31, 2020, 2019 and 2018, respectively. Material costs as a percentage of product revenue vary from product to product due to differences in average selling prices, material requirements, product thicknesses and manufacturing yields. In addition, we provide warranties for our products and record the estimated cost within cost of revenue in the period that the related revenue is recorded or when we become aware that a potential warranty claim is probable and can be reasonably estimated. As a result of these factors, material costs as a percentage of product revenue will vary from period to period due to changes in the mix of aerogel products sold, the costs of our raw materials or the estimated cost of warranties. We expect that material costs will decrease in absolute dollars during 2021 due to a favorable product mix and the impact of our bill of material cost initiatives.

During the year ended December 31, 2018, we experienced a significant increase in the costs of certain silica precursor materials, which constitute over 50% of our raw material costs. In response, we have achieved higher selling prices, implemented lower cost formulations, implemented material sourcing improvements, and enhanced manufacturing yields to reduce the cost of raw materials for our aerogel products. As a result, we expect that material costs will decrease both in absolute dollars and as a percentage of product revenue during 2021.

Manufacturing expense is also a significant component of cost of revenue. Manufacturing expense includes labor, utilities, maintenance expense, and depreciation on manufacturing assets. Manufacturing expense also includes stock-based compensation of manufacturing employees and shipping costs. Manufacturing expense as a percentage of product revenue was 42%, 33% and 42% for the years ended December 31, 2020, 2019 and 2018, respectively. While product revenue decreased by 27% during 2020, manufacturing expense decreased by only 8% due principally to the high proportion of fixed manufacturing expense in our East Providence, Rhode Island manufacturing facility. In 2021, we expect that manufacturing expense in both absolute dollars and as a percentage of product revenue will remain level with 2020 as a projected increase in compensation costs is offset by a projected decrease in depreciation expense.

In total, we expect that cost of product revenue will decrease in absolute dollars during 2021 and as a percentage of product revenue during 2021 versus 2020 due primarily to a projected favorable product mix and the impact of our on-going initiatives to reduce our bill of material costs.

Cost of research services revenue consists of direct labor costs of research personnel engaged in the contract research, third-party consulting and subcontractor expense, and associated direct material costs. This cost of revenue also includes overhead expenses associated with project resources, development tools and supplies. Cost of research services revenue is recorded when the related research services revenue is recognized. In 2021, we expect that cost of research services revenue will decline as we wind down our existing contract research activities.

Gross Profit

Our gross profit as a percentage of revenue is affected by a number of factors, including the volume of aerogel products produced and sold, the mix of aerogel products sold, average selling prices, our material and manufacturing costs, realized capacity utilization and the costs associated with expansions and start-up of production capacity. Accordingly, we expect our gross profit in absolute dollars and as a percentage of revenue to vary significantly from period to period.

During 2020, we experienced a significant decline in product revenue due to the impact of COVID-19 on the global energy infrastructure market and a decrease in research services revenue resulting from our decision to wind down our contract research activities. We experienced a reduction in both our material costs and manufacturing expense due to the decrease in volume, our efforts to control compensation costs and discretionary expense, and our initiatives to reduce our bill of material costs. Due principally to high proportion of fixed manufacturing expense in our manufacturing operations, the material cost and manufacturing expense reductions were insufficient to offset the full impact of the revenue decline. As a result, gross profit decreased both in absolute dollars and as a percentage of revenue during the year.

During 2021, we expect that the COVID-19 pandemic will continue to constrain our revenue to 2020 levels. However, we expect gross profit to increase both in absolute dollars and as a percentage of revenue during 2021 due to a projected favorable product mix and the impact of our on-going initiatives to reduce our bill of material costs.

In the longer term, we expect gross profit to continue to improve in absolute dollars and as a percentage of revenue due to expected increases in total revenue, production volumes and manufacturing productivity. In addition, we expect the gross profit improvement derived from the increases in revenue, volume and productivity will be supported by the continued implementation of lower cost product formulations and realization of material purchasing efficiencies.

Operating Expenses

Operating expenses consist of research and development, sales and marketing, and general and administrative expenses. Operating expenses include personnel costs, legal fees, professional fees, service fees, insurance premiums, travel expense, facilities related costs and other costs, expenses and fees. The largest component of our operating expenses is personnel costs, consisting of salaries, benefits, incentive compensation and stock-based compensation. In any particular period, the timing and extent of personnel additions or reductions, legal activities, including patent enforcement actions, marketing programs, research efforts and a range of similar activities or actions could materially affect our operating expenses, both in absolute dollars and as a percentage of revenue.

During 2021, we expect to hire additional personnel and incur additional operating expenses to support the anticipated multi-year growth in our PyroThin thermal barrier business. As a result, we expect that operating expenses will increase in both absolute dollars and as a percentage of revenue during the year. In the longer term, we expect that operating expenses will increase in absolute dollars, but decrease as a percentage of revenue.

Research and Development Expenses

Research and development expenses consist primarily of expenses for personnel engaged in the development of next generation aerogel compositions, form factors and manufacturing technologies. These expenses also include testing services, prototype expenses, consulting services, trial formulations for new products, equipment depreciation, facilities costs and related overhead. We expense research and development costs as incurred. We expect to continue to devote substantial resources to the development of new aerogel technologies, including our carbon aerogel battery materials. We believe that these investments are necessary to maintain and improve our competitive position. We also expect to continue to invest in research and engineering personnel and the infrastructure required in support of their efforts. While we expect that our research and development expenses will increase in absolute dollars but decrease as a percentage of revenue in the longer term, in 2021 we expect such expenses will increase in both absolute dollars and as a percentage of revenue.

Sales and Marketing Expenses

Sales and marketing expenses consist primarily of personnel costs, incentive compensation, marketing programs, travel and related costs, consulting expenses and facilities related costs. We expect that sales and marketing expenses will increase in absolute dollars during 2021 principally due to an increase in compensation associated with the addition of personnel in support of our PyroThin thermal barrier business.

General and Administrative Expenses

General and administrative expenses consist primarily of personnel costs, legal expenses, consulting and professional services, audit and tax consulting costs, and expenses for our executive, finance, legal, human resources and information technology organizations. General and administrative expenses have increased as we have incurred additional costs related to operating as a publicly-traded company, which include costs of compliance with securities, corporate governance and related laws and regulations, investor relations expenses, increased insurance premiums, including director and officer insurance, and increased audit and legal fees. In addition, we expect our general and administrative expenses to increase as we add general and administrative personnel to support the anticipated growth of our business. We also expect that the patent enforcement actions, described in more detail under "Legal Proceedings" in Part I, Item 3 of this Annual Report on Form 10-K, if protracted, could result in significant legal expense over the medium to long-term. While we expect that our general and administrative expenses will increase in absolute dollars but decrease as a percentage of revenue in the longer term, in 2021 we expect such expenses will increase in both absolute dollars and as a percentage of revenue.

During the year ended 2020, the Company was in technical discussions with the U.S. Environmental Protection Agency (EPA) in connection with the EPA's notice of potential violation and opportunity to confer that the Company received regarding the applicability of certain Resource Conservation and Recovery Act (RCRA) provisions to certain aspects of its manufacturing unit operations. The EPA notice was in connection with the EPA's RCRA Compliance Evaluation Inspection of the Company's East Providence, Rhode Island manufacturing facility in May 2019. Subsequent to these initial discussions, the Company received notice from the EPA that there were no violations with respect to its manufacturing unit operations.

Interest Expense, Net

For the years ended December 31, 2020, 2019, and 2018, interest expense, net consisted primarily of fees and interest expense related to our revolving credit facility.

Provision for Income Taxes

We have incurred net losses since inception and have not recorded benefit provisions for U.S. federal income taxes or state income taxes since the tax benefits of our net losses have been offset by valuation allowances due to the uncertainty associated with the utilization of net operating loss carryforwards.

At December 31, 2020, we had \$250.6 million of net operating losses available to offset future federal income, if any, of which \$194.6 million expire on various dates through December 31, 2037. Net operating losses of \$56.0 million generated during the three-year period ended December 31, 2020 have an unlimited carryforward.

Results of Operations

The following tables set forth our results of operations for the periods presented:

		Year Ended December 31,						
	_	2020	2019	2018				
			(\$ in thousands)					
Revenue:								
Product	\$	99,834	\$ 136,934	\$ 102,123				
Research services	_	439	2,441	2,238				
Total revenue	_	100,273	139,375	104,361				
Cost of revenue:								
Product		85,545	111,759	90,660				
Research services		134	1,332	1,032				
Gross profit	_	14,594	26,284	12,669				
Operating expenses:								
Research and development		8,729	8,407	6,319				
Sales and marketing		11,753	15,557	13,794				
General and administrative		15,681	16,479	19,116				
Impairment of construction in progress		_	_	7,356				
Total operating expenses	_	36,163	40,443	46,585				
Loss from operations	_	(21,569)	(14,159)	(33,916)				
Interest expense, net	_	(240)	(406)	(524)				
Total interest expense, net	-	(240)	(406)	(524)				
Net loss	\$	(21,809)	\$ (14,565)	\$ (34,440)				
	=							

Year ended December 31, 2020 compared to year ended December 31, 2019

The following tables set forth our results of operations for the periods presented:

			Year Ended l		Year End December		
	 2020		2019	\$ Change	% Change	2020	2019
	(\$ in thousands)			(Percentag total rever			
Revenue:							
Product	\$ 99,834	\$	136,934	\$ (37,100)	(27)%	100%	98%
Research services	439		2,441	(2,002)	(82)%	0%	2%
Total revenue	 100,273		139,375	(39,102)	(28)%	100%	100%
Cost of revenue:							
Product	85,545		111,759	(26,214)	(23)%	85%	80%
Research services	134		1,332	(1,198)	(90)%	0%	1%
Gross profit	 14,594		26,284	(11,690)	(44)%	15%	19%
Operating expenses:							
Research and development	8,729		8,407	322	4%	9%	6%
Sales and marketing	11,753		15,557	(3,804)	(24)%	12%	11%
General and administrative	15,681		16,479	(798)	(5)%	16%	12%
Total operating expenses	 36,163		40,443	(4,280)	(11)%	36%	29%
Loss from operations	 (21,569)		(14,159)	(7,410)	52%	(22)%	(10)%
Interest expense, net	 (240)		(406)	166	(41)%	(0)%	(0)%
Total interest expense, net	 (240)		(406)	166	(41)%	(0)%	(0)%
Net loss	\$ (21,809)	\$	(14,565)	\$ (7,244)	50%	(22)%	(10)%

Revenue

		Year Ended De		Change				
	 2020			2019				
	 Amount	Percentage of Revenue			Percentage of Revenue	Amount		Percentage
	(\$ in thousands)							
Revenue:								
Product	\$ 99,834	100%	\$	136,934	98%	\$	(37,100)	(27)%
Research services	439	0%		2,441	2%		(2,002)	(82)%
Total revenue	\$ 100,273	100%	\$	139,375	100%	\$	(39,102)	(28)%

The following chart sets forth product shipments in square feet associated with recognized revenue, including revenue recognized over time utilizing the input method, for the periods presented:

	Year En	ded		
	Decembe	r 31,	Chan	ige
	2020	2019	Amount	Percentage
Product shipments in square feet (in thousands)	28,635	40,720	(12,085)	(30)%

Total revenue decreased \$39.1 million, or 28%, to \$100.3 million in 2020 from \$139.4 million in 2019. The decrease in total revenue was the result of decreases in both product revenue and research services revenue.

Product revenue decreased by \$37.1 million, or 27%, to \$99.8 million in 2020 from \$136.9 million in 2019. This decrease was principally the result of COVID-19 related decreases in both project and maintenance-based demand in the global energy infrastructure market, offset, in small part, by growth in the building materials market and the impact of our 2020 price increase.

Product revenue for the year ended December 31, 2020 included \$20.7 million in sales to Distribution International, Inc. and \$15.3 million in sales to SPCC Joint Venture. Product revenue for the year ended December 31, 2019 included \$27.3 million in sales to Distribution International, Inc. and \$18.0 million in sales to SPCC Joint Venture. The average selling price per square foot of our products increased by \$0.13, or 4%, to \$3.49 per square foot for the year ended December 31, 2020 from \$3.36 per square foot for the year ended December 31, 2019. The increase in average selling price principally reflected the impact of price increases enacted in 2020. This increase in average selling price had the effect of increasing product revenue by approximately \$3.6 million for the year ended December 31, 2020.

In volume terms, product shipments decreased by 12.1 million square feet, or 30%, to 28.6 million square feet of aerogel products for the year ended December 31, 2020, as compared to 40.7 million square feet in the year ended December 31, 2019. The decrease in product volume had the effect of decreasing product revenue by approximately \$40.7 million for the year ended December 31, 2020.

Research services revenue decreased by \$2.0 million, or 82%, to \$0.4 million in 2020 from \$2.4 million in 2019. The decrease was primarily due to our decision to wind down our contract research activities to focus our research and development resources on improving the profitability of our existing business and developing new products and next-generation technology with application in new, high value markets.

Product revenue as a percentage of total revenue was greater than 99% of total revenue in 2020 and 98% of total revenue in 2019. Research services revenue was less than 1% of total revenue in 2020 and 2% of total revenue in 2019. We expect that product revenue will compose virtually all of our total revenue in the long-term.

During 2021, we expect that the COVID-19 pandemic will continue to constrain our revenue to 2020 levels with some potential for additional project-related revenue. When the effects of the COVID-19 pandemic recede, we anticipate that our revenue will increase with the elimination of contractor access restrictions in energy infrastructure facilities and as our distribution channel restocks.

Cost of Revenue

			Year Ended I	December 31,			Cha	nge
		2020						
	Amount	Percentage of Related Revenue	Percentage of Total Revenue	Amount	Percentage of Related Revenue	Percentage of Total Revenue	Amount	Percentage
				(\$ in the	ousands)			
Cost of revenue:								
Product	\$ 85,545	86%	85%	\$ 111,759	82%	80%	\$ (26,214)	(23)%
Research services	134	31%	0%	1,332	55%	1%	(1,198)	(90)%
Total cost of revenue	\$ 85,679	85%	85%	\$ 113,091	81%	81%	\$ (27,412)	(24)%

Total cost of revenue decreased \$27.4 million, or 24%, to \$85.7 million in 2020 from \$113.1 million in 2019. The decrease in total cost of revenue was the result of decreases in both product cost of revenue and research services cost of revenue.

Product cost of revenue decreased \$26.2 million, or 23%, to \$85.5 million in 2020 from \$111.8 million in 2019. The \$26.2 million decrease was the result of a \$22.7 million decrease in material costs and a \$3.5 million decrease in manufacturing expense. The decrease in material costs was driven principally by the 12.1 million square feet, or 30%, decrease in product shipments and the impact of our bill of material cost reduction initiatives. The decrease in manufacturing expense was primarily driven by decreases in variable plant and operating costs of \$2.3 million and compensation and related costs of \$1.2 million.

Product cost of revenue as a percentage of product revenue increased to 86% in 2020 from 82% in 2019. This increase was the result of the high proportion of fixed manufacturing expenses in our East Providence manufacturing facility that remained essentially unchanged despite a 27% decrease in product revenue in 2020, offset, in part, by the impact of our 2020 price increases, bill of material sourcing efficiencies, and discretionary expense controls in response to the COVID-19 pandemic.

We expect that product cost of revenue will decrease both in absolute dollars and as a percentage of product revenue during 2021 versus 2020 due principally to a projected favorable product mix and the impact of our on-going initiatives to reduce our bill of material costs.

Research services cost of revenue decreased by \$1.2 million, or 90%, to \$0.1 million in 2020 from \$1.3 million in 2019. Cost of research service revenue as a percentage of research services revenue decreased to 31% in 2020 from 55% in 2019 due to our decision to wind down existing research activities.

Gross Profit

			Year Ended Dec	Change				
		202	0		201	9		
			Percentage			Percentage		
	Amount		mount of Revenue		nount	of Revenue	Amount	Percentage
				(\$ in thousands)				
Gross profit	\$	14,594	15% 5	\$	26,284	19%	\$ (11,690)	(44)%

Gross profit decreased \$11.7 million, or 44%, to \$14.6 million in 2020 from \$26.3 million in 2019. The decrease in gross profit was the result of the \$39.1 million decrease in total revenue, offset, in part, by the \$27.4 million decrease in total cost of revenue. The decrease in revenue was principally the result of COVID-19 related decreases in both project and maintenance-based demand in the global energy infrastructure market, offset, in small part, by growth in our building materials business and the impact of our 2020 price increase. The decrease in total cost of revenue was principally the result of the 12.1 million square feet, or 30%, decrease in product shipments.

Gross profit as a percentage of total revenue decreased to 15% in 2020 from 19% in 2019. This decrease was principally the result of the high proportion of fixed manufacturing expenses in our East Providence manufacturing facility that remained essentially unchanged despite the 27% decrease in product revenue in 2020.

During 2021, we expect that the COVID-19 pandemic will continue to constrain our revenue to 2020 levels. However, we expect gross profit to increase both in absolute dollars and as a percentage of revenue during 2021 due to a projected favorable product mix and the impact of our on-going initiatives to reduce our bill of material costs.

Research and Development Expenses

			Year Ended D	ecember 31	,	Change			
	_	20	020		2019				
		Amount	Percentage of Revenue	Amoun	Percentage of Revenue	Amount	Percentage		
				(§ in thousands)				
Research and development expenses	\$	8,729	9%	\$ 8,	107 69	6 \$ 32	22 4%		

Research and development expenses increased by \$0.3 million, or 4%, to \$8.7 million in 2020 from \$8.4 million in 2019. The \$0.3 million increase reflected of our decision to focus research activities on the development of new products and next-generation technology with application in new, high value markets, including the electric vehicle market.

Research and development expenses as a percentage of total revenue increased to 9% during the year ended December 31, 2020 from 6% during the comparable period in 2019. The increase was the result of both the increase in research and development expenses and the decrease in total revenue.

We expect that our research and development expenses to increase in both absolute dollars and as a percentage of revenue during 2021 in line with our decision to increase resources dedicated to the development of new aerogel products and technologies, including our carbon aerogel battery materials.

In the long-term, we expect to continue to increase investment in research and development in our efforts to enhance and expand our aerogel technology platform. However, we expect that research and development expenses will decline as a percentage of total revenue in the long-term due to projected growth in product revenue.

Sales and Marketing Expenses

	Year Ended December 31,						Change		ge
	2020			2019					
			Percentage			Percentage			
	A	mount	of Revenue	A	Amount	of Revenue		Amount	Percentage
					(\$ in thous	sands)			
Sales and marketing expenses	\$	11,753	12%	\$	15,557	11%	\$	(3,804)	(24)%

Sales and marketing expenses decreased by \$3.8 million, or 24%, to \$11.8 million in 2020 from \$15.6 million in 2019. The decrease was the result of decreases in compensation and related costs of \$1.7 million, travel and related costs of \$1.3 million, sales consultant costs of \$0.6 million, and other expenses of \$0.2 million.

Sales and marketing expenses as a percentage of total revenue increased to 12% in 2020 from 11% in 2019 primarily due to the decrease in overall revenue of 28%.

We expect sales and marketing expenses to increase in both absolute dollars and as a percentage of revenue during 2021 due principally to a planned increase in marketing expense during the year.

In the long-term, we expect that sales and marketing expenses will increase in absolute dollars as we continue to increase sales personnel and marketing efforts in support of expected growth in demand for our products. However, we expect that sales and marketing expenses will decrease as a percentage of total revenue in the long-term due to projected growth in product revenue.

General and Administrative Expenses

			Year Ended De	Change			
	<u> </u>	20	20	20	019		
	·		Percentage	Percentage			
	_	Amount	of Revenue	Amount	of Revenue	Amount	Percentage
				(\$ in th	ousands)		
General and administrative expenses	\$	15,681	16%	\$ 16,479	12%	\$ (798)	(5)%

General and administrative expenses decreased by \$0.8 million, or 5%, to \$15.7 million in 2020 from \$16.5 million in 2019. The \$0.8 million decrease was the result of decreases in patent enforcement costs of \$0.6 million, professional and legal fees of \$0.3 million, compensation and related costs of \$0.3 million and other general administrative expenses of \$0.1 million, offset in part by an increase in the provision for bad debts of \$0.3 million and a \$0.2 million decrease in recoveries of bad debt in 2020 as compared to 2019.

General and administrative expenses as a percentage of total revenue increased to 16% in 2020 from 12% in 2019 primarily due to the 28% decrease in revenue in 2020.

We expect general and administrative expenses to increase in both absolute dollars and as a percentage of revenue during 2021.

We expect to increase general and administrative personnel and expense levels in the long term to support the anticipated growth of our business and continued expansion of our manufacturing operations. We also expect that the patent enforcement actions, described in more detail under "Legal Proceedings" in part I, Item 3, of this Annual Report on Form 10-K, could result in significant additional legal expense over the medium-to-long term. In the longer term, we expect that general and administrative expenses will increase in absolute dollars but decrease as a percentage of revenue due to projected growth in product revenue.

Interest Expense, Net

			Year Ended De	Change					
		2020			2019				.
			Percentage	entage		Percentage			
	A	mount	of Revenue	Aı	mount	of Revenue		Amount	Percentage
		(\$ in thousands)							
Interest expense, net	\$	(240)	(0)%	\$	(406)	(0)%	\$	166	(41)%

Interest expense, net, consisting primarily of fees and interest expense associated with outstanding balances under our revolving credit agreement, was \$0.2 million and \$0.4 million in 2020 and 2019, respectively.

Year ended December 31, 2019 compared to year ended December 31, 2018

The following tables set forth our results of operations for the periods presented:

		Year Ended December 31,						Year Ended December 31,		
	2019		2018 \$ Change		% Change	2019	2018			
			(\$ in	thousands)				(Percentage of total revenue)		
Revenue:										
Product	\$	136,934	\$	102,123	\$	34,811	34%	98%	98%	
Research services		2,441		2,238		203	9%	2%	2%	
Total revenue		139,375		104,361		35,014	34%	100%	100%	
Cost of revenue:										
Product		111,759		90,660		21,099	23%	80%	87%	
Research services		1,332		1,032		300	29%	1%	1%	
Gross profit		26,284		12,669		13,615	107%	19%	12%	
Operating expenses:										
Research and development		8,407		6,319		2,088	33%	6%	6%	
Sales and marketing		15,557		13,794		1,763	13%	11%	13%	
General and administrative		16,479		19,116		(2,637)	(14)%	12%	18%	
Impairment of construction in progress		_		7,356		(7,356)	100%	_	%	
Total operating expenses		40,443		46,585		(6,142)	(13)%	29%	45%	
Loss from operations		(14,159)		(33,916)		19,757	(58)%	(10)%	(32)%	
Interest expense, net		(406)		(524)		118	(23)%	(0)%	(1)%	
Total interest expense, net		(406)		(524)		118	(23)%	(0)%	(1)%	
Net loss	\$	(14,565)	\$	(34,440)	\$	19,875	(58)%	(10)%	(33)%	

Revenue

			Year Ended D	Change			
	_	20:	19		2018		
		Amount	Percentage of Revenue	Amount	Percentage of Revenue	Amount	Percentage
				(\$ in t	housands)		
Revenue:							
Product	\$	136,934	98%	\$ 102,123	98%	\$ 34,811	34%
Research services		2,441	2%	2,238	2%	203	9%
Total revenue	\$	139,375	100%	\$ 104,361	100%	\$ 35,014	34%

The following chart sets forth product shipments in square feet associated with recognized revenue, including revenue recognized over time utilizing the input method, for the periods presented:

	Year End December		Change		
	2019	2018	Amount	Percentage	
Product shipments in square feet (in thousands)	40,720	34,435	6,285	18%	

Total revenue increased \$35.0 million, or 34%, to \$139.4 million in 2019 from \$104.4 million in 2018 primarily as a result of an increase in product revenue.

Product revenue increased by \$34.8 million, or 34%, to \$136.9 million in 2019 from \$102.1 million in 2018. This increase was principally the result of growth in the North American petrochemical and refinery markets, an increase in project-based demand in the LNG and subsea markets, and the impact of price increases enacted in early 2019, offset, in part, by decreases in shipments to the building materials and Asian petrochemical markets.

Product revenue for the year ended December 31, 2019 included \$27.3 million in sales to Distribution International, Inc. and \$18.0 million in sales to SPCC Joint Venture. Product revenue for the year ended December 31, 2018 included \$21.4 million in sales to Distribution International, Inc.

The average selling price per square foot of our products increased by \$0.40, or 14%, to \$3.36 per square foot for the year ended December 31, 2019 from \$2.96 per square foot for the year ended December 31, 2018. The increase in average selling price principally reflected the impact of price increases enacted in early 2019. This increase in average selling price had the effect of increasing product revenue by approximately \$16.2 million for the year ended December 31, 2019.

In volume terms, product shipments increased by 6.3 million square feet, or 18%, to 40.7 million square feet of aerogel products for the year ended December 31, 2019, as compared to 34.4 million square feet in the year ended December 31, 2018. The increase in product volume had the effect of increasing product revenue by approximately \$18.6 million for the year ended December 31, 2019.

Research services revenue increased by \$0.2 million, or 9%, to \$2.4 million in 2019 from \$2.2 million in 2018. The increase was primarily due to the timing and amount of funding available under research contracts during the year ended December 31, 2019 from the comparable period in 2018.

Product revenue as a percentage of total revenue was 98% of total revenue in both 2019 and 2018. Research services revenue was 2% of total revenue in both 2019 and 2018. We expect that product revenue will comprise virtually all of our total revenue in the long-term.

Cost of Revenue

				Change							
		2019			2018						
	Amount	Percentage of Related Revenue	Percentage of Total Revenue	Amount	Percentage of Related Revenue	Percentage of Total Revenue	Amount	Percentage			
		(\$ in thousands)									
Cost of revenue:					,						
Product	\$ 111,759	82%	80%	\$ 90,660	89%	87%	\$ 21,099	23%			
Research services	1,332	55%	1%	1,032	46%	1%	300	29%			
Total cost of revenue	\$ 113,091	81%	81%	\$ 91,692	88%	88%	\$ 21,399	23%			

Total cost of revenue increased \$21.4 million, or 23%, to \$113.1 million in 2019 from \$91.7 million in 2018. The increase in total cost of revenue was primarily the result of an increase in product cost of revenue.

Product cost of revenue increased \$21.1 million, or 23%, to \$111.8 million in 2019 from \$90.7 million in 2018. The \$21.1 million increase was the result of an \$18.3 million increase in material costs and a \$2.8 million increase in manufacturing expense. The increase in material costs was driven principally by the 6.3 million square feet, or 18%, increase in product shipments and an unfavorable mix of products sold. The increase in manufacturing expense was the result of increases in compensation and related costs of \$1.7 million, waste disposal expense of \$0.7 million and other manufacturing expenses of \$0.4 million.

Product cost of revenue as a percentage of product revenue decreased to 82% in 2019 from 89% in 2018. This decrease was the result of the high proportion of fixed manufacturing expenses that remained essentially unchanged despite the 34% increase in product revenue in 2019, offset, in part, by the increase in material costs during the year.

Research services cost of revenue increased by \$0.3 million, or 29%, to \$1.3 million in 2019 from \$1.0 million in 2018. Cost of research service revenue as a percentage of research services revenue increased to 55% in 2019 from 46% in 2018 due to an increase in the proportion of third-party contract services utilized to support the contracted research.

Gross Profit

		Year Ended Dec	Change			
	 2019		2018			
		Percentage		Percentage		
	 Amount	of Revenue	Amount	of Revenue	Amount	Percentage
			(\$ in the	ousands)		
Gross profit	\$ 26,284	19% 5	\$ 12,669	12%	\$ 13,615	107%

Gross profit increased \$13.6 million, or 107%, to \$26.3 million in 2019 from \$12.7 million in 2018. The increase in gross profit was the result of the \$35.0 million increase in total revenue, offset, in part, by the \$21.4 million increase in total cost of revenue. The increase in revenue was principally associated with growth in the North American petrochemical and refinery markets, an increase in project-based demand in the LNG and subsea markets, and the impact of price increases enacted in early 2019, offset, in part, by a

decrease in shipments to the building materials and Asian petrochemical markets. The increase in total cost of revenue was driven principally by the 6.3 million square feet, or 18%, increase in product shipments and the unfavorable mix of products sold.

Gross profit as a percentage of total revenue increased to 19% of total revenue in 2019 from 12% in 2018. This increase was principally the result of the high proportion of fixed manufacturing expenses that remained essentially unchanged despite the 34% increase in product revenue in 2019.

Research and Development Expenses

			Year Ende	d Decem	ber 31,			Cha	nge
	<u></u>	20	19		20	18			
		Amount	Percentage of Revenue	A	Amount	Percentage of Revenue		Amount	Percentage
					(\$ in tho	usands)			
Research and development expenses	\$	8,407	6	% \$	6,319		6% 5	2,088	33%

Research and development expenses increased by \$2.1 million, or 33%, to \$8.4 million in 2019 from \$6.3 million in 2018. The \$2.1 million increase was the result of increases in compensation and related costs of \$1.7 million and other research and development costs of \$0.4 million.

Research and development expenses as a percentage of total revenue remained unchanged at 6% during the year ended December 31, 2019 from the comparable period in 2018.

Sales and Marketing Expenses

		Year Ended Dec	cember 31,		Cha	nge
	 201	2018		18		
	 	Percentage		Percentage		ъ.
	 Amount	of Revenue	Amount	of Revenue	Amount	Percentage
			(\$ in the	ousands)		
Sales and marketing expenses	\$ 15,557	11% 5	\$ 13,794	13%	\$ 1,763	13%

Sales and marketing expenses increased by \$1.8 million, or 13%, to \$15.6 million in 2019 from \$13.8 million in 2018. The increase was the result of an increase in compensation and related costs of \$1.6 million and professional fees of \$0.6 million, offset, in part, by a decrease in marketing expenses of \$0.4 million.

Sales and marketing expenses as a percentage of total revenue decreased to 11% in 2019 from 13% in 2018 due to the 34% increase in revenue, offset, in part, by the 13% increase in sales and marketing expenses in 2019.

General and Administrative Expenses

			Year Ended Do	ecemb	er 31,		Char	ige
		201	19		20	18		
			Percentage			Percentage		
	A	mount	of Revenue	Ar	nount	of Revenue	Amount	Percentage
					(\$ in tho	usands)		
General and administrative expenses	\$	16,479	12%	\$	19,116	18%	\$ (2,637)	(14)%

General and administrative expenses decreased by \$2.6 million, or 14%, to \$16.5 million in 2019 from \$19.1 million in 2018. The \$2.6 million decrease was the result of decreases in provision for uncollectible accounts of \$3.1 million, professional fees of \$0.4 million, and other general administrative expenses of \$0.1 million, offset, in part, by increases in compensation and related costs of \$0.9 million and patent enforcement costs of \$0.1 million.

General and administrative expenses as a percentage of total revenue decreased to 12% in 2019 from 18% in 2018 due to both the 14% decrease in general and administrative expenses and the 34% increase in revenue in 2019.

Impairment of Construction In Progress

We had previously completed the design and engineering for a second manufacturing facility to be located in Statesboro, Georgia. During 2016, we elected to delay construction of the facility due to our assessment of future demand. In December 2018, we determined that we would not use the existing design and engineering to construct a second facility in any location. Accordingly, we determined that the design and engineering costs were not recoverable and recorded an impairment charge of \$7.4 million on construction in progress assets in 2018. We did not record any impairments of construction in progress in 2019.

Interest Expense, net

			Year Ended De	ecember	31,		Cha	nge
		201	9		2018			
			Percentage			Percentage		
	Am	ount	of Revenue	Am	ount	of Revenue	Amount	Percentage
					(\$ in thousa	ands)		
Interest expense, net	\$	(406)	(0)%	\$	(524)	(1)%	\$ 118	(23)%

Interest expense, net, consisting primarily of fees and interest expense associated with outstanding balances under our revolving credit agreement, was \$0.4 million and \$0.5 million in 2019 and 2018, respectively.

Liquidity and Capital Resources

Overview

We have experienced significant losses and invested substantial resources since our inception to develop, commercialize and protect our aerogel technology and to build a manufacturing infrastructure capable of supplying aerogel products at the volumes and costs required by our customers. These investments have included research and development and other operating expenses, capital expenditures and investment in working capital balances.

Through 2015, we experienced revenue growth and gained share in our target markets. Despite a decline in revenue in 2016, 2017 and 2018, our financial projections anticipated long-term revenue growth, increasing levels of gross profit and improved cash flow from operations. To support this growth, we initiated a plan in 2018 to increase the capacity of our East Providence, Rhode Island manufacturing facility to approximately 60 million square feet of aerogel blankets and currently expect to achieve this goal by the end of 2021. We may incur additional capital expenditures to complete this plan in 2021.

We are also increasing our investment in the research and development of next-generation aerogel products and technologies. During 2021, we will continue to develop aerogel products and technologies for the electric vehicle market. We believe the commercial potential for our technology in the electric vehicle market is significant and could require us to hire additional personnel, incur additional operating expenses, build an automated thermal barrier fabrication operation, and construct a carbon aerogel battery materials facility, among other items.

In addition, we anticipate that we will need to increase our aerogel blanket manufacturing capacity to keep pace with the significant potential demand for our PyroThin thermal barriers. Accordingly, we are in the early stages of planning a significant expansion of our aerogel capacity prior to the end of 2023. The expected elements of the completed expansion plan will include the size of the required capacity expansion, the selection of an optimal manufacturing site for the expansion, the appropriate financing structure to fund the project fully and a detailed timeline for the construction and operation of the facility. We expect that we will incur significant increase in capital expenditures to build out the additional capacity and in operating expenses associated with the start-up of the facility.

We took several actions during 2020 to increase the financial resources available to support current operating requirements and capital expenditures. In February 2020, we completed an underwritten public offering of our common stock and received net proceeds of \$14.8 million. In March 2020, we extended the maturity of our revolving credit facility with Silicon Valley Bank to April 28, 2021. In May 2020, our wholly owned subsidiary, Aspen Aerogels Rhode Island, LLC, received PPP Loan proceeds of \$3.7 million under the CARES Act. During November and December 2020, we also completed the sale of 714,357 shares of our common stock at an average price of \$13.96 per share through our at-the-market offering and received net proceeds of \$9.5 million after deducting commissions \$0.3 million and offering expenses of approximately \$0.2 million, pursuant to the ATM offering program with B. Riley Securities as our sales agent.

We believe that our existing cash balance and funds available under our revolving credit facility will be sufficient to support current operating requirements and research and development activities. However, we believe that our cash balance and funds available under the revolving credit facility will not be sufficient to fund the capital expenditures required to establish an automated thermal barrier fabrication operation, build a carbon aerogel battery materials facility, and to construct a new aerogel blanket manufacturing facility.

As a result, we plan to supplement our cash balance with additional credit facilities, debt financings, customer prepayments, technology licensing fees or equity financings to provide the capital necessary to fund operating requirements, to complete future capacity expansions or to support evolving strategic business initiatives. We also intend to extend or replace our revolving credit facility with Silicon Valley Bank prior to its maturity.

Primary Sources of Liquidity

Our principal sources of liquidity are currently our cash and cash equivalents and our revolving credit facility with Silicon Valley Bank. Cash and cash equivalents consist primarily of cash and money market accounts on deposit with banks. As of December 31, 2020, we had \$16.5 million of cash and cash equivalents.

On February 18, 2020, we completed an underwritten public offering of 1,955,000 shares of our common stock at an offering price of \$8.25 per share. We received net proceeds of \$14.8 million after deducting underwriting discounts and commissions of \$1.1 million and offering expenses of approximately \$0.3 million.

On November 5, 2020, we entered into a sales agreement for an at-the-market offering program (ATM) under which we may sell up to \$33,871,250 of our common stock through B. Riley Securities, Inc. We are not obligated to sell any stock under the sales agreement. We will pay B. Riley a commission of 3.0% of the gross sales proceeds of shares sold under the agreement. During November and December 2020, we sold 714,357 shares of our stock through the ATM and received net proceeds of \$9.5 million.

On May 1, 2020, our wholly-owned subsidiary, Aspen Aerogels Rhode Island, LLC (Borrower) executed a note for a loan of \$3.7 million pursuant to the PPP under the CARES Act, as amended, and administered by the SBA. The loan is unsecured, contains customary events of default, carries an interest rate of 1% per year, and matures on May 1, 2022. The Borrower may repay the loan in full at any time without penalty. In addition, the Borrower may apply to have the maturity of loan extended to May 1, 2025.

The Borrower may apply to have the PPP Loan indebtedness forgiven in whole or in part subject to SBA guidelines and based on the use of loan proceeds for payroll costs, mortgage interest payments, rent and utility costs over either an eight-week or 24-week period, at the Borrower's option, following its receipt of the loan proceeds. The SBA may disapprove of the Borrower's loan forgiveness application if the agency determines that the Borrower was ineligible for the PPP Loan. As of December 31, 2020, the Borrower had not applied for forgiveness.

If the Borrower applies for, but does not receive forgiveness of the PPP Loan in whole or in part, the Borrower will be required to make payments of the remaining principal and accrued interest in equal monthly installments over the remaining term of the loan. If the Borrower does not apply for forgiveness by August 19, 2021, the Borrower will be required to make payments of principal and accrued interest in equal monthly installments over the remaining term of the loan.

We have maintained our revolving credit facility, as amended from time to time, with Silicon Valley Bank since March 2011. On March 3, 2020, we amended our revolving credit facility to extend the maturity date of the facility to April 28, 2021. The amendment also established certain minimum levels with respect to the minimum Adjusted EBITDA financial covenant for the extended term. We further amended our revolving credit facility with Silicon Valley Bank to revise the minimum Adjusted EBITDA financial covenant on December 24, 2020, among other things. On March 12, 2021, we amended and restated our revolving credit facility with Silicon Valley Bank to extend the maturity date of the revolving credit facility to April 28, 2022 and to establish certain minimum Adjusted EBITDA levels with respect to the minimum Adjusted EBITDA and minimum Adjusted Quick Ratio covenants, as defined. We intend to extend or replace the facility prior to its maturity.

Under our revolving credit facility, we may borrow a maximum of \$20.0 million, subject to continued covenant compliance and borrowing base requirements. At our election, the interest rate applicable to borrowings under the revolving credit facility may be based on the prime rate or LIBOR, subject to a minimum rate of 4.00% per annum. Prime rate-based rates vary from prime rate plus 0.75% per annum to prime rate plus 2.00% per annum, while LIBOR-based rates vary from LIBOR plus 3.75% per annum to LIBOR plus 4.25% per annum. In addition, we are required to pay a monthly unused revolving line facility fee of 0.50% per annum of the average unused portion of the revolving credit facility.

Under the revolving credit facility, we are required to comply with both non-financial and financial covenants, including the minimum Adjusted EBITDA covenant, as defined in the loan agreement. At December 31, 2020, we were in compliance with all such covenants. The amount available to us under the revolving credit facility at December 31, 2020 was \$5.4 million after giving effect to \$1.4 million in outstanding letters of credit.

At December 31, 2020, we had no outstanding borrowings under our revolving credit facility with Silicon Valley Bank, \$1.4 million of outstanding letters of credit secured by the revolving credit facility, \$3.7 million outstanding on the PPP Loan, and an obligation of \$9.8 million associated with prepayments received pursuant to our supply agreement with BASF.

See "Risk Factors -- Risks Related to Our Business and Strategy -- We will require significant additional capital to pursue our growth strategy, but we may not be able to obtain additional financing on acceptable terms or at all" in this Annual Report on Form 10-K for the year ended December 31, 2020.

Analysis of Cash Flow

The following table summarizes our cash flows for the periods indicated:

	Year Ended December 31,					
		2020		2019		2018
			(\$ in	thousands)		
Net cash provided by (used in):						
Operating activities	\$	(9,924)	\$	(1,054)	\$	(8,654)
Investing activities		(3,416)		(2,112)		(3,593)
Financing activities		26,203		3,472		4,880
Net increase (decrease) in cash		12,863		306		(7,367)
Cash, beginning of period		3,633		3,327		10,694
Cash and cash equivalents, end of period	\$	16,496	\$	3,633	\$	3,327

Operating Activities

During 2020, we used \$9.9 million in net cash in operating activities, as compared to the use of \$1.1 million in net cash during 2019, an increase in the use of cash of \$8.8 million. This increase in the use of cash was the result of the increase in net loss adjusted for non-cash items of \$5.7 million, and a decrease in cash provided by changes in working capital of \$3.1 million.

During 2019, we used \$1.1 million in net cash in operating activities, as compared to the use of \$8.7 million in net cash during 2018, a decrease in the use of cash of \$7.6 million. This decrease in use of cash was the result of the decrease in net loss adjusted for non-cash items of \$9.6 million, offset, in part, by a decrease in cash provided by changes in working capital of \$2.0 million.

Investing Activities

Net cash used in investing activities is for capital expenditures principally for machinery and equipment to improve the throughput, efficiency and capacity of our East Providence facility. Net cash used in investing activities for 2020 and 2019 totaled \$3.4 million and \$2.1 million, respectively.

Financing Activities

Net cash provided by financing activities in 2020 totaled \$26.2 million and consisted of \$19.4 million in borrowings under our revolving credit facility, \$14.8 million in net proceeds from an underwritten public offering of our common stock, \$9.5 million in net proceeds from our at-the-market offering, \$3.7 million in net proceeds from the issuance of long term debt and \$2.6 million in proceeds from employee stock option exercises, offset, in part, by \$22.6 million of repayments under our revolving credit facility and \$1.2 million for payments for employee tax withholdings associated with the vesting of restricted stock units.

Net cash provided by financing activities in 2019 totaled \$3.5 million and consisted of \$125.8 million in borrowings under our revolving credit facility and \$5.0 million in prepayment proceeds under the BASF supply agreement, offset, in part, by \$126.8 million of repayments under our revolving credit facility and \$0.5 million for payments for employee tax withholdings associated with the vesting of restricted stock units.

Capital Spending and Future Capital Requirements

We have made capital expenditures primarily to develop and expand our manufacturing capacity. Our capital expenditures totaled \$3.4 million in 2020, \$2.1 million in 2019 and \$3.6 million in 2018. As of December 31, 2020, we had capital commitments of approximately \$1.0 million, which included commitments for which we have entered into contracts as well as commitments authorized by our Board of Directors and relate to the enhancement of our existing production lines in our East Providence facility. These commitments consist primarily of costs for equipment and construction.

We intend to fund capital expenditures related the expansion of capacity of our existing manufacturing facility with our existing cash balance, available credit and anticipated cash flows from operations. We plan to fund the capital expenditures required to establish an automated thermal barrier fabrication operation, build a carbon aerogel battery materials facility, and to construct a new aerogel blanket manufacturing facility with additional credit facilities, debt financings, customer prepayments, technology licensing fees or equity financings.

Off-Balance Sheet Arrangements

Since inception, we have not engaged in any off-balance sheet activities as defined in Item 303(a)(4) of Regulation S-K.

Contractual Obligations and Commitments

Operating Leases

We lease office space for our corporate offices in Northborough, Massachusetts, which expires in 2026, and warehouse space and land near our East Providence facility, which expire at various dates through 2024, under non-cancelable operating lease agreements. See "Item 2 — Properties." We also lease vehicles and equipment under non-cancelable operating leases that expire at various dates.

On June 29, 2016, we entered into a lease with Cabot II- MA1M03, LLC, or Cabot Properties, to lease approximately 51,650 square feet of space located at 30 Forbes Road, Northborough, MA 01532, the location of our current headquarters. The lease superseded a lease between us and Cabot Properties' predecessor-in-interest. The term of the lease began on January 1, 2017 and ends on December 31, 2026. The annual base rent associated with the lease was approximately \$408,000 during 2017 and has and will increase by approximately 3% annually during the lease term. The lease also provides for our payment of our pro rata share of real estate taxes and certain other expenses. Upon the expiration of the lease term, we will have the right to extend the lease for an additional three years.

Thermal Barrier Contract

We are party to a contract with a major U.S. automotive original equipment manufacturer to supply fabricated, multi-part thermal barriers for use in the battery system of its next-generation electric vehicles. Pursuant to the contract, we are obligated to supply the thermal barriers at fixed annual prices and at volumes to be specified by the manufacturer up to a daily maximum quantity through the term of the agreement, which expires on September 1, 2026. While the manufacturer has agreed to purchase its requirement for the thermal barriers at locations to be designated from time to time from us, it has no obligation to purchase any minimum quantity of the barriers under the contract. In addition, the manufacturer may terminate the contract any time and for any or no reason. All other terms of the contract are generally consistent with the manufacturers standard purchase terms, including customary quality and warranty provisions.

Supply Agreement

In June 2016, we entered into a supply agreement and a side agreement with BASF SE. In February 2018, we entered into an amended and restated supply agreement and side agreement with BASF Polyurethanes GmbH (BASF). On January 14, 2019, we entered into the first addendum to the supply agreement with BASF (as amended and restated and after giving effect to the first addendum, the supply agreement). Pursuant to the supply agreement, we will sell exclusively to BASF certain products at annual volumes to be specified by BASF, subject to specified volume limits. Pricing is based on a cost-plus formula. The supply agreement also specifies the markets in which BASF is permitted to sell each of the products. BASF has no obligation to purchase any of the products under the supply agreement. The supply agreement will terminate on December 31, 2027 with respect to our Spaceloft A2

product, and on December 31, 2028 with respect to the newly developed product, if not renewed prior to such dates. Upon expiration of the supply agreement, we will be subject to a post-termination supply commitment for the specified products for an additional two years.

In addition to the customary terms associated with supply agreements, BASF, in its sole discretion, may make prepayments to us in the aggregate amount of up to \$22.0 million during the term of the supply agreement. BASF made two prepayments to us in the aggregate amount of \$5.0 million during 2018. BASF made an additional prepayment of \$5.0 million to us in January 2019. We have secured our obligation to repay the prepayments with a first priority security interest in real estate, machinery and equipment located at our existing manufacturing facility in East Providence, Rhode Island. Additionally, we granted non-exclusive licenses to our Rhode Island subsidiary under our intellectual property as necessary to operate such machinery and equipment.

Beginning January 1, 2019, we credited 25.3% of any amounts that we invoice for Spaceloft A2 sold to BASF against the outstanding balance of the 2018 prepayment. If any of the 2018 prepayment remains uncredited as of December 31, 2021, BASF may request that we repay the uncredited amount to BASF following a six-week notice period. Since January 1, 2020, we credit 50% of any amounts that we invoice for a newly developed product sold to BASF against the outstanding balance of the 2019 prepayment. After December 31, 2022, BASF may elect to have us credit 24.7% of any amounts we invoice for Spaceloft A2 sold to BASF against the outstanding balance of the 2019 prepayment or may request that we repay the uncredited amount to BASF. The specific terms of additional tranches of prepayments, if any, are to be agreed by us and BASF at a future date.

We may repay any prepayment balance to BASF at any time in whole or in part for any reason. In the event of a sale of all or substantially all of our assets or a change of control of Aspen, BASF may in certain instances have the right to terminate the supply agreement, in which case any remaining balance of prepayments as of such sale or change of control will be due and payable to BASF within 30 days of the relevant transaction.

Joint Development Agreement

In June 2016, we and BASF SE also entered into a Joint Development Agreement, or the JDA, setting forth the rights and obligations of us and BASF SE with respect to collaboration on the development and commercialization of new products. Under the JDA, each party may propose that the parties enter into joint efforts to seek to develop one or more products or services for commercialization on terms to be agreed by the parties. The JDA established a joint steering committee with equal representation from each of us and BASF SE to oversee any such collaboration. Unless otherwise agreed, all intellectual property created in the performance of joint development activities will generally be jointly owned by us and BASF SE. The JDA will have an initial term of two years or the duration of any project in process, with the option for the parties to renew at the expiration. Either party may terminate the JDA for any reason with 90-days prior notice to the other party, provided that such termination will not terminate any project under the JDA then in progress, with any such ongoing project able to be terminated by either party for any reason on 90-days prior notice to the other party.

Revolving Credit Facility

In March 2011, we entered into a revolving credit facility with Silicon Valley Bank. This facility has been amended at various dates through December 2020. On March 12, 2021, we amended and restated our revolving credit facility with Silicon Valley Bank to extend the maturity date of the revolving credit facility to April 28, 2022 and to establish certain minimum Adjusted EBITDA levels with respect to the minimum Adjusted EBITDA and minimum Adjusted Quick Ratio covenants, as defined. Under our revolving credit facility, we are permitted to borrow a maximum of \$20.0 million, subject to continued covenant compliance and borrowing base requirements. The interest rate applicable to borrowings under the revolving credit facility is based on the prime rate, subject to a minimum rate of 4.00% per annum. Prime rate-based rates vary from prime rate plus 0.75% per annum to prime rate plus 2.00% per annum. In addition, we are required to pay a monthly unused revolving line of credit facility fee of 0.50% per annum of the average unused portion of the revolving credit facility. We intend to extend or replace the facility prior to its maturity

At December 31, 2020, the amount available to us under the revolving credit facility was \$5.4 million after giving effect to \$1.4 million in letters of credit outstanding under the facility.

Recently Issued Accounting Standards

From time to time, new accounting pronouncements are issued by the Financial Accounting Standards Board (FASB) or other standard setting bodies. Recently issued standards typically do not require adoption until a future effective date. Prior to their effective date, the Company evaluates the pronouncements to determine the potential effects of adoption to its consolidated financial statements.

Standards Implemented Since December 31, 2019

The Company has not implemented any accounting standards that had a material impact on its consolidated financial statements during the year ended December 31, 2020.

Standards to be Implemented

The Company believes that the impact of recently issued accounting standards that are not yet effective will not have a material impact on its consolidated financial statements.

Critical Accounting Policies and Estimates

Our financial statements are prepared in accordance with accounting principles generally accepted in the United States of America. The preparation of our financial statements and related disclosures requires us to make estimates, assumptions and judgments that affect the reported amount of assets, liabilities, revenue, costs and expenses and related disclosures. We believe that the estimates, assumptions and judgments involved in these accounting policies have the greatest potential impact on our financial statements; and therefore, we consider these to be our critical accounting policies. Accordingly, we evaluate our estimates and assumptions on an ongoing basis. Our actual results may differ from these estimates under different assumptions and conditions. See note 2 to our consolidated financial statements included elsewhere in this Annual Report on Form 10-K for information about these critical accounting policies, as well as a description of our other significant accounting policies.

Revenue Recognition

We recognize product revenue from the sale of our line of aerogel products and research services revenue from the provision of services under contracts with various agencies of the U.S. government and other institutions. Product and research services revenue is recognized upon the satisfaction of contractual performance obligations. In general, our customary shipping terms are FOB shipping point. Products are typically delivered without significant post-sale obligations to customers other than standard warranty obligations for product defects. We provide warranties for our products and record the estimated cost within cost of sales in the period that the revenue is recorded. Our standard warranty period extends one to two years from the date of shipment, depending on the type of product purchased. Our warranties provide that our products will be free from defects in material and workmanship, and will, under normal use, conform to the specifications for the product.

We did not record any warranty expense during the years ended December 31, 2020, 2019, and 2018. As of December 31, 2020, we had satisfied all outstanding warranty claims.

Research services revenue is derived from the execution of contracts awarded by the U.S. government, other government agencies and other institutions. Our research service arrangements require us to perform research to investigate new forms and applications of aerogel technology. We record revenue earned on research services contracts using the percentage-of-completion method in two ways: (1) for firm-fixed-price contracts, we accrue that portion of the total contract price that is allocable, on the basis of our estimates of costs incurred to date to total contract cost; (2) for cost-plus-fixed-fee contracts, we record revenue that is equal to total payroll cost incurred times a stated factor plus reimbursable expenses, to a stated upper limit. The primary cost in these arrangements is the labor effort expended in completing the research. Typically, the only deliverable, other than labor hours expended, is reporting research results to the customer or delivery of research grade aerogel products. Because the input measure of labor hours expended is also reflective of the output measure, it is a reliable means to measure the extent of progress towards completion. Contract costs and rates used to allocate overhead to contracts are subject to audit by the respective contracting government agency. Revisions in cost estimates and fees during the course of the contract are reflected in the accounting period in which the facts that require the revisions become known. In 2019, we decided to wind down our existing contract research activities. This decision reflected our desire to focus our research and development resources on initiatives to improve the profitability of our existing business and on efforts to develop new products and next-generation technology with application in new, high value markets.

Stock-based Compensation

We maintain an equity incentive plan pursuant to which our board of directors may grant qualified and nonqualified stock options, restricted stock, restricted stock units and other stock-based awards to board members, officers, key employees and others who provide or have provided service to us.

We measure the costs associated with stock-based awards based on their estimated fair value at date of grant. We recognize the cost of stock-based awards as service, performance or market conditions are met. Future expense amounts for any particular quarterly or annual period could be affected by changes in our assumptions or changes in market conditions.

Stock Options

We use the Black-Scholes option-pricing model to estimate the fair value of stock option awards. The determination of the estimated fair value of stock option awards is based on a number of complex and subjective assumptions. These assumptions include the determination of the estimated fair value of the underlying security, the expected volatility of the underlying security, a risk-free interest rate, the expected term of the option, and the forfeiture rate for the award class. The following assumptions were used to estimate the fair value of the option awards:

		Year Ended December 31,	
	2020	2019	2018
Weighted-average assumptions:			
Expected term (in years)	5.96	5.81	5.93
Expected volatility	52.27%	49.90%	47.68%
Risk free rate	1.08%	2.44%	2.76%
Expected dividend yield	—%	%	<u>%</u>

- The expected term represents the period that our stock-based awards are expected to be outstanding and is determined using the simplified method described in ASC Topic 718, Compensation Stock Compensation, for all grants. We believe this is a better representation of the estimated life than our actual limited historical exercise behavior.
- For the years ended December 31, 2020, 2019 and 2018, the expected volatility is primarily based on the weighted-average volatility of up to 17
 companies within various industries that we believe are similar to our own. The Company expects to have sufficient historical data to develop an
 estimated volatility for future awards.
- The risk-free interest rate is based on U.S. Treasury zero-coupon issues with a remaining term equal to the expected life assumed at the date of grant.
- We use an expected dividend yield of zero, since we do not intend to pay cash dividends on our common stock in the foreseeable future, nor have we paid dividends on our common stock in the past.

For stock options that contained a market condition issued to our chief executive officer during the year ended December 31, 2015, we used a Monte Carlo Simulation model to estimate the grant date fair value of awards expected to vest. We based the simulation model on the Black Scholes option-pricing model and a number of other complex assumptions including (i) whether the vesting condition would be satisfied within the time-vesting periods, and (ii) the date the common stock price target would be achieved per the terms of the agreement. On November 7, 2018, we entered into an amended executive agreement with our CEO that modified the change in control provisions for the outstanding stock options that contained a market condition. This modification resulted in the recognition of additional compensation expense of less than \$0.1 million during the year ended December 31, 2018. On December 10, 2020, we modified the vesting conditions of NSOs to purchase 116,279 of common stock held by our CEO to extend the time period to achieve the common stock price target. We accounted for the extension of the time period as a modification and recognized \$1.1 million of incremental stock compensation expense during the year ended December 31, 2020.

For the restricted stock award issued to our Chief Executive Officer during the year ended December 31, 2015 that contains a performance condition, we assess the probability that the performance condition will be satisfied. On August 2, 2017, we modified the performance target with respect to 78,125 shares of these awards. As of December 31, 2020, the performance condition was not achieved and the award expired by its terms.

During 2020, we estimated the fair value of the modified NSOs to purchase 116,279 of common stock held by our Chief Executive Officer by use of the Black-Scholes option-pricing model assuming an expected term of 2.5 years, an expected volatility of 67.23%, a risk-free rate of 0.17% and an expected dividend yield of zero.

Item 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

Market risk represents the risk of loss that may impact our financial position due to adverse changes in financial market prices and rates. Our market risk exposure results primarily from fluctuations in interest rates as well as from inflation. In the normal course of business, we are exposed to market risks, including changes in interest rates which affect our line of credit under our revolving credit facility as well as cash flows. We may also face additional exchange rate risk in the future as we expand our business internationally.

Interest Rate Risk

We are exposed to changes in interest rates in the normal course of our business. At December 31, 2020, we had unrestricted cash and cash equivalents of \$16.5 million. These amounts were held for working capital and capital expansion purposes and were invested primarily in deposit accounts at a major financial institution in North America. Due to the short-term nature of these investments, we believe that our exposure to changes in the fair value of our cash as a result of changes in interest rates is not material.

As of December 31, 2020, we had no outstanding amounts drawn on our revolving credit facility. At December 31, 2020, we had \$1.4 million of outstanding letters of credit supported by the revolving credit facility.

Under our revolving credit facility, we are permitted to borrow a maximum of \$20.0 million, subject to continued covenant compliance and borrowing base requirements. The interest rate applicable to borrowings under the revolving credit facility is based on the prime rate, subject to a minimum rate of 4.00% per annum. Prime rate-based rates vary from prime rate plus 0.75% per annum to prime rate plus 2.00% per annum. In addition, we are required to pay a monthly unused revolving line facility fee of 0.50% per annum of the average unused portion of the revolving credit facility. The maturity date of our revolving credit facility is April 28, 2022. We intend to extend or replace the facility prior to its maturity.

At December 31, 2020, the amount available to us under the revolving credit facility was \$5.4 million after giving effect to the \$1.4 million of letters of credit outstanding under the facility.

Our PPP Loan has an interest rate of 1% per annum and matures on May 1, 2022. In accordance with the Flexibility Act, we may submit an application to extend the maturity of the loan by three years to May 1, 2025. At December 31, 2020, the PPP Loan had an outstanding balance of \$3.7 million.

Inflation Risk

Although we expect that our operating results will be influenced by general economic conditions, we do not believe that inflation has had a material effect on our results of operations during the periods presented in this report. However, our business may be affected by inflation in the future.

Foreign Currency Exchange Risk

We are subject to inherent risks attributed to operating in a global economy. Virtually all of our revenue, receivables, purchases and debts are denominated in U.S. dollars.

Report of Independent Registered Public Accounting Firm

To the Stockholders and Board of Directors

Aspen Aerogels, Inc.:

Opinions on the Consolidated Financial Statements and Internal Control Over Financial Reporting

We have audited the accompanying consolidated balance sheets of Aspen Aerogels, Inc. and subsidiaries (the Company) as of December 31, 2020 and 2019, the related consolidated statements of operations, stockholders' equity, and cash flows for each of the years in the three-year period ended December 31, 2020, and the related notes and financial statement schedule II - Valuation and Qualifying Accounts (collectively, the consolidated financial statements). We also have audited the Company's internal control over financial reporting as of December 31, 2020, based on criteria established in *Internal Control – Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2020 and 2019, and the results of its operations and its cash flows for each of the years in the three-year period ended December 31, 2020, in conformity with U.S. generally accepted accounting principles. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2020 based on criteria established in *Internal Control – Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission.

Change in Accounting Principle

As discussed in Note 2 to the consolidated financial statements, the Company has changed its method of accounting for leases as of January 1, 2019 due to the adoption of Accounting Standards Codification (ASC) Topic 842, Leases.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management's Report on Internal Control over Financial Reporting. Our responsibility is to express an opinion on the Company's consolidated financial statements and an opinion on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control Over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matter

The critical audit matter communicated below is a matter arising from the current period audit of the consolidated financial statements that was communicated or required to be communicated to the audit committee and that: (1) relates to accounts or disclosures that are material to the consolidated financial statements and (2) involved our especially challenging, subjective, or complex judgments. The communication of a critical audit matter does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

Evaluation of net realizable value of certain inventories

As discussed in Note 2 to the consolidated financial statements, inventories are stated at the lower of cost or net realizable value. As of December 31, 2020, the Company held inventories of \$13.1 million. The excess, obsolete or damaged goods provision recorded for inventories is equal to the difference between the cost of inventory and the estimated net realizable value, which is based upon an analysis of existing inventory quantities compared to estimated future consumption. Future consumption is estimated based upon past consumption, recent sales, or other demand factors indicative of future consumption.

We identified the evaluation of the estimated net realizable value of certain inventories as a critical audit matter. A high degree of auditor judgment was required to evaluate whether past consumption and recent sales are indicative of future consumption which is required to accomplish the accounting objective of recording inventory at the lower of its cost or net realizable value.

The following are the primary procedures we performed to address this critical audit matter. We evaluated the design and tested the operating effectiveness of certain internal controls related to the critical audit matter. This included a control over the Company's process used to estimate future consumption. We assessed the Company's assumptions about how past consumption and recent sales indicate future consumption, and the impact of relevant changes to the overall business environment, including key customers and product lines. We compared the actual quantities of inventory on hand to actual consumption and sales transactions during the current year and subsequent to year-end. We recalculated the Company's estimate of the cumulative inventory write downs based on the actual quantity of product on hand compared to the estimate of future consumption.

/s/ KPMG LLP

We have served as the Company's auditor since 2002.

Hartford, Connecticut March 12, 2021

ASPEN AEROGELS, INC. Consolidated Balance Sheets

		December 31,				
		2020		2019		
		(In thousa share and pe	nds, except er share date			
Assets		share and pe	1 share date	<i>a)</i>		
Current assets:						
Cash and cash equivalents	\$	16,496	\$	3,633		
Accounts receivable, net of allowances of \$442 and \$144		15,698		32,254		
Inventories		13,099		8,768		
Prepaid expenses and other current assets		1,830		1,114		
Total current assets		47,123		45,769		
Property, plant and equipment, net		46,739		53,617		
Operating lease right-of-use assets		3,478		4,032		
Other long-term assets		84		84		
Total assets	\$	97,424	\$	103,502		
Liabilities and Stockholders' Equity						
Current liabilities:						
Accounts payable	\$	5,351	\$	12,596		
Accrued expenses		3,884		8,057		
Current portion of long-term debt		1,609		· —		
Revolving line of credit		_		3,123		
Deferred revenue		2,037		5,620		
Operating lease liabilities		1,046		1,038		
Total current liabilities		13,927		30,434		
Prepayment liability		9,555		9,786		
Long-term debt		2,059		_		
Operating lease liabilities long-term		3,597		4,292		
Other long-term liabilities		434				
Total liabilities		29,572		44,512		
Commitments and contingencies (Note 11)						
Stockholders' equity:						
Preferred stock, \$0.00001 par value; 5,000,000 shares authorized, no shares issued or outstanding at December 31, 2020 and 2019		_		_		
Common stock, \$0.00001 par value; 125,000,000 shares authorized, 27,821,685 and						
24,302,504 shares issued and outstanding at December 31, 2020 and December 31,						
2019, respectively		_		_		
Additional paid-in capital		575,811		545,140		
Accumulated deficit		(507,959)		(486,150)		
Total stockholders' equity		67,852		58,990		
Total liabilities and stockholders' equity	\$	97,424	\$	103,502		
1	-	,	<u> </u>	,- ,		

ASPEN AEROGELS, INC. Consolidated Statements of Operations

		Year Er	ided December 31,	
	 2020		2019	2018
			ousands, except nd per share data)	
Revenue:				
Product	\$ 99,834	\$	136,934	\$ 102,123
Research services	 439		2,441	 2,238
Total revenue	100,273		139,375	104,361
Cost of revenue:				
Product	85,545		111,759	90,660
Research services	 134		1,332	 1,032
Gross profit	14,594		26,284	12,669
Operating expenses:				 _
Research and development	8,729		8,407	6,319
Sales and marketing	11,753		15,557	13,794
General and administrative	15,681		16,479	19,116
Impairment of construction in progress	 <u> </u>		<u> </u>	 7,356
Total operating expenses	36,163		40,443	46,585
Loss from operations	(21,569)		(14,159)	 (33,916)
Interest expense, net	 (240)		(406)	(524)
Total interest expense, net	(240)		(406)	(524)
Net loss	\$ (21,809)	\$	(14,565)	\$ (34,440)
Net loss per share:	 	-		
Basic and diluted	\$ (0.83)	\$	(0.60)	\$ (1.45)
Weighted-average common shares outstanding:	 			
Basic and diluted	 26,377,652		24,099,438	23,738,852

ASPEN AEROGELS, INC.

Consolidated Statements of Stockholders' Equity (In thousands, except share and per share data)

	\$0.000	ed Stock 01 Par llue	Commor \$0.0000 Val	1 Par	-	dditional Paid-in Capital	Accumulated Deficit	Total Stockholders' Equity
	Shares	Value	Shares	Value				
Balance at December 31, 2017	_	\$ —	23,643,189	\$ —	\$	538,088	\$ (437,145)	\$ 100,943
Net loss							(34,440)	(34,440)
Stock compensation expense	_	_	_	_		4,302	_	4,302
Issuance of restricted stock			58,062					
Vesting of restricted stock units			272,266			(551)		(551)
Balance at December 31, 2018		<u> </u>	23,973,517	<u> </u>	\$	541,839	\$ (471,585)	\$ 70,254
Net loss						_	(14,565)	(14,565)
Stock compensation expense	_	_	_	_		3,771	_	3,771
Issuance of restricted stock	_	_	50,328	_		_	_	_
Vesting of restricted stock units			278,659			(470)		(470)
Balance at December 31, 2019		<u>\$</u>	24,302,504	<u>\$</u>	\$	545,140	\$ (486,150)	\$ 58,990
Net loss	_	_	_	_		_	(21,809)	(21,809)
Stock compensation expense	_	_	_	_		5,004	_	5,004
Issuance of restricted stock	_	_	45,066	_		_	_	_
Vesting of restricted stock units	_	_	344,158	_		(1,219)	_	(1,219)
Proceeds from employee stock option exercises	_	_	460,600	_		2,661	_	2,661
Proceeds from underwritten public offering, net of underwriting discounts and								
commissions of \$1,093 and issuance costs of \$285	_	_	1,955,000	_		14,751	_	14,751
Proceeds from at-the-market offering, net of commissions and fees of \$299 and								
issuance costs of \$199			714,357		_	9,474		9,474
Balance at December 31, 2020		<u> </u>	27,821,685	<u> </u>	\$	575,811	\$ (507,959)	\$ 67,852

ASPEN AEROGELS, INC.

Consolidated Statements of Cash Flows

	Year Ended December 3				31,		
		2020		2019		2018	
			(In	thousands)			
Cash flows from operating activities:	¢.	(21.000)	Ф	(14.565)	Ф	(24.440)	
Net loss	\$	(21,809)	\$	(14,565)	2	(34,440)	
Adjustments to reconcile net loss to net cash used in operating activities:		10 100		10.212		10,787	
Depreciation Impairment of construction in process		10,198		10,213		7,356	
Amortization of debt issuance costs		9				7,550	
Provision for bad debt		325		_		2,922	
Stock compensation expense		5,004		3,771		4,302	
Reduction in the carrying amount of operating lease right-of-use assets		971		947		.,502	
Lease incentives		_		_		(121)	
Changes in operating assets and liabilities:						()	
Accounts receivable		16,231		(6,689)		(1,723)	
Inventories		(4,331)		(1,450)		1,597	
Prepaid expenses and other assets		(716)		(84)		261	
Accounts payable		(7,149)		141		1,557	
Accrued expenses		(4,173)		4,344		(2,056)	
Deferred revenue		(3,814)		3,392		810	
Operating lease liabilities		(1,104)		(1,018)		_	
Other liabilities		434		(56)		94	
Net cash used in operating activities		(9,924)		(1,054)		(8,654)	
Cash flows from investing activities:							
Capital expenditures		(3,416)		(2,112)		(3,593)	
Net cash used in investing activities		(3,416)		(2,112)		(3,593)	
Cash flows from financing activities:							
Proceeds from underwritten public offering, net of underwriting discounts and commissions of \$1,093		15,036		_		_	
Issuance costs from underwritten public offering		(285)		_		_	
Proceeds from issuance of long-term debt		3,686		_		_	
Issuance costs from long-term debt		(27)		_			
Prepayment proceeds under customer supply agreement		_		5,000		5,000	
Proceeds from employee stock option exercises		2,661					
Payments made for employee restricted stock tax withholdings		(1,219)		(470)		(551)	
Proceeds from at-the-market offering net of commissions and fees of \$299		9,673		_			
Issuance costs from at-the-market offering		(199)		(1.050)		- 421	
Proceeds from (repayments of) borrowings under line of credit, net		(3,123)		(1,058)		431	
Net cash provided by financing activities		26,203		3,472		4,880	
Net increase (decrease) in cash		12,863		306		(7,367)	
Cash and cash equivalents at beginning of period	Φ.	3,633	Φ.	3,327	Φ.	10,694	
Cash and cash equivalents at end of period	\$	16,496	\$	3,633	\$	3,327	
Supplemental disclosures of cash flow information:							
Interest paid	\$	216	\$	440	\$	338	
Income taxes paid	\$		\$		\$		
Supplemental disclosures of non-cash activities:	<u></u>	_	<u> </u>				
Initial recognition of operating lease liabilities related to right-of-use assets	\$		\$	5,995	\$		
Right-of-use assets obtained in exchange for new operating lease liabilities	\$	417	\$	353	\$	_	
Changes in accrued capital expenditures	\$	(96)	\$	63	\$	182	
Capitalized interest	\$		\$		\$	44	
Capitanzoa interest	φ		Ψ		Ψ	44	

ASPEN AEROGELS, INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

(1) Description of Business

Nature of Business

Aspen Aerogels, Inc. (the Company) is an aerogel technology company that designs, develops and manufactures innovative, high-performance aerogel insulation used primarily in the energy infrastructure and building materials markets. In addition, the Company is developing high value applications for its aerogel technology in the electric vehicle market. The Company also conducts research related to aerogel technology supported by funding from several agencies of the U.S. government and other institutions in the form of research contracts. The Company has decided to cease efforts to secure additional funded research contracts and to wind down existing contract research activities.

The Company maintains its corporate offices in Northborough, Massachusetts. The Company has three wholly owned subsidiaries: Aspen Aerogels Rhode Island, LLC, Aspen Aerogels Germany, GmbH and Aspen Aerogels Georgia, LLC.

On June 18, 2014, the Company completed the initial public offering (IPO) of its common stock.

Liquidity

During the year ended December 31, 2020, the Company incurred a net loss of \$21.8 million and used \$9.9 million of cash in operations. On February 18, 2020, the Company received net proceeds of \$14.8 million upon the completion of an underwritten public offering of the Company's common stock. On May 4, 2020, Aspen Aerogels Rhode Island, LLC received loan proceeds of \$3.7 million upon the execution of a promissory note pursuant to the Paycheck Protection Program (PPP) established by the Coronavirus Aid, Relief and Economic Security Act (CARES Act) and administered by the U.S. Small Business Administration (SBA) (see note 8). During November and December 2020, the Company received net proceeds of \$9.5 million through an at-the-market offering of the Company's stock. The Company had cash and cash equivalents of \$16.5 million, total debt of \$3.7 million and no outstanding borrowings under its revolving line of credit as of December 31, 2020 (see note 7). After giving effect to the \$1.4 million of outstanding letters of credit, the amount available to the Company at December 31, 2020 under the revolving line of credit was \$5.4 million. The existing revolving line of credit matures on April 28, 2022.

The Company is increasing investment in the research and development of next-generation aerogel products and manufacturing process technologies. The Company is continuing to develop aerogel products and technologies for the electric vehicle market. The commercial potential for the Company's technology in the electric vehicle market is significant and could require the Company to hire additional personnel, incur additional operating expenses, and incur capital expenditures to expand aerogel manufacturing capacity, build an automated fabrication operation, and construct a battery materials facility, among other items.

The Company expects its existing cash balance and the amount anticipated to be available under the existing revolving line of credit will be sufficient to support current operating requirements and research and development activities. However, the Company plans to supplement its cash balance and available credit with debt financings, customer prepayments, technology licensing fees or equity financings to provide the capital necessary to fund the evolving commercial opportunity in the electric vehicle market and other strategic business opportunities.

(2) Summary of Basis of Presentation and Significant Accounting Policies

Principles of Consolidation

The accompanying consolidated financial statements, which have been prepared in accordance with U.S. generally accepted accounting principles (U.S. GAAP), include the accounts of the Company and its wholly owned subsidiaries. All intercompany balances and transactions have been eliminated in consolidation.

Use of Estimates

The preparation of the consolidated financial statements requires the Company to make a number of estimates and assumptions that affect the reported amounts of assets and liabilities at the date of the consolidated financial statements and the reported amounts of revenues and expenses during the reporting period. Significant items subject to such estimates and assumptions include allowances for doubtful accounts, sales returns and allowances, product warranty costs, inventory valuation, the carrying amount of property and equipment, stock-based compensation and deferred income taxes. The Company evaluates its estimates and assumptions on an ongoing basis using historical experience and other factors, including current economic conditions, which are believed to be reasonable under the circumstances.

Management adjusts such estimates and assumptions when facts and circumstances warrant. Illiquid credit markets, volatile equity markets and declines in business investment can increase the uncertainty inherent in such estimates and assumptions. As future events and their effects cannot be determined with precision, actual results could differ significantly from these estimates. Changes in these estimates resulting from continuing changes in the economic environment will be reflected in the financial statements in future periods.

Cash and Cash Equivalents

Cash equivalents include short-term, highly liquid instruments, which consist of money market accounts. All cash and cash equivalents are maintained with major financial institutions in North America. Deposits with these financial institutions may exceed the amount of insurance provided on such deposits; however, these deposits typically may be redeemed upon demand and, therefore, bear minimal risk.

Concentration of Credit Risk

Financial instruments, which potentially expose the Company to concentrations of credit risk, consist principally of accounts receivable. The Company's customers are primarily insulation distributors, insulation contractors, insulation fabricators and select end-users located throughout the world. The Company performs ongoing credit evaluations of its customers' financial condition and generally requires no collateral to secure accounts receivable. The Company maintains an allowance for doubtful accounts based on its assessment of the collectability of accounts receivable. The Company reviews the allowance for doubtful accounts quarterly. During the year ended December 31, 2020, the Company recorded a charge for estimated customer uncollectible accounts receivable of \$0.3 million. During the year ended December 31, 2019, the Company did not record any charges for uncollectible accounts receivable. During the year ended December 31, 2018, the Company recorded a charge for uncollectible accounts receivable of \$2.9 million related to four customers of which one customer accounted for \$2.8 million. During the year ended December 31, 2019, the Company received collections of \$0.3 million from this customer. The Company subsequently determined that collection of the remaining unpaid accounts receivable from this customer of \$2.6 million was unlikely due to the customer's filing of judicial reorganization under Brazilian laws. Therefore, the Company recorded a write-off of the accounts receivable and the corresponding allowance for doubtful accounts. During 2020, the Company established an estimated reserve for uncollectible accounts receivable for \$0.3 million. Allowance for doubtful accounts was \$0.3 million and zero at December 31, 2020 and 2019, respectively. The Company does not have any off-balance-sheet credit exposure related to its customers.

For the year ended December 31, 2020, two customers represented 21% and 15% of total revenue, respectively. For the year ended December 31, 2019, two customers represented 20% and 13% of total revenue, respectively. For the year ended December 31, 2018, one customer represented 20% of total revenue

At December 31, 2020, the Company had one customer which accounted for 26% of accounts receivable. At December 31, 2019, the Company had two customers that accounted for 19% and 16% of accounts receivable, respectively.

Inventories

Inventory consists of finished products and raw materials. Inventories are carried at lower of cost, determined using the first-in, first-out (FIFO) method, and net realizable value. Cost includes materials, labor and manufacturing overhead. Manufacturing overhead is allocated to the costs of conversion based on normal capacity of the Company's production facility. Abnormal freight, handling costs and material waste is expensed in the period it occurs.

The Company periodically reviews its inventories and makes provisions as necessary for estimated excess, obsolete or damaged goods to ensure values approximate the lower of cost and net realizable value. The amount of any such provision is equal to the difference between the cost of inventory and the estimated net realizable value based upon assumptions about future demand, selling prices and market conditions.

Property, Plant and Equipment, Net

Property, plant and equipment are stated at cost. Expenditures for maintenance and repairs are charged to expense as incurred. Expenditures for major betterments are capitalized as additions to property, plant and equipment.

Depreciation on plant and equipment is calculated on the straight-line method over the estimated useful lives of the assets. Assets related to leasehold improvements are amortized on a straight-line basis over the shorter of the lease term or estimated useful life of the asset.

Assets utilized in the Company's operations that are taken out of service with no future use are charged to cost of revenue or operating expenses, depending on the department in which the asset was utilized. Impairments of construction in progress are charged to operating expenses upon the determination of no future use.

Other Assets

Other assets primarily include long-term deposits.

Impairment of Long-Lived Assets

Long-lived assets are reviewed for impairment when events or changes in circumstances indicate that the carrying amount of an asset or asset group may not be recoverable. Recognition and measurement of a potential impairment is performed on assets grouped with other assets and liabilities at the lowest level where identifiable cash flows are largely independent of the cash flows of other assets and liabilities. Recoverability of assets to be held and used is measured by a comparison of the carrying amount of an asset or asset group to future undiscounted net cash flows expected to be generated by the asset or asset group. If the carrying amount of an asset or asset group exceeds its estimated undiscounted future cash flows, an impairment charge is recognized for the amount by which the carrying amount of the asset or asset group exceeds the fair value of the asset or asset group. Fair value is determined through various valuation techniques including discounted cash flow models, quoted market values and third-party independent appraisals, as considered necessary.

During 2016, the Company completed the design and engineering for a second manufacturing facility to be located in Statesboro, Georgia. At that time, the Company elected to delay construction of the facility due to its assessment of future demand. In December 2018, the Company determined that due to its cumulative manufacturing process advancements since 2016 and expected additional improvements in the near future, it would not use the existing design and engineering to construct a second facility in any location. Accordingly, the Company determined that the design and engineering costs were not recoverable and recorded an impairment charge of \$7.4 million on construction in progress assets during 2018.

Leases

On January 1, 2019, the Company adopted Accounting Standards Update (ASU) 2016-02, Leases (Topic 842). See note 10 for further details.

Revenue Recognition

The Company recognizes revenue in accordance with Accounting Standards Codification 606, Revenue from Contracts with Customers (ASC 606). See note 3 for further details.

Warranty

The Company provides warranties for its products and records the estimated cost within cost of revenue in the period that the related revenue is recorded. The Company's standard warranty period extends to one year from the date of shipment. This standard warranty provides that the Company's products will be free from defects in material and workmanship, and will, under normal use, conform to the specifications for the product.

The Company's products may be utilized in systems that involve new technical demands and new configurations. Accordingly, the Company regularly reviews and assesses whether warranty reserves should be recorded in the period the related revenue is recorded. For an initial shipment of product for use in a system with new technical demands or new configurations and where the

Company is unsure of meeting the customer's specifications, the Company will defer the recognition of product revenue and related costs until written customer acceptance is obtained.

The Company did not record any warranty expense during the years ended December 31, 2020, 2019 and 2018.

Shipping and Handling Costs

Shipping and handling costs are classified as a component of cost of revenue. Customer payments of shipping and handling costs are recorded as product revenue.

Stock-based Compensation

The Company grants share-based awards to its employees and non-employee directors. All share-based awards granted, including grants of stock options, restricted stock and restricted stock units (RSUs), are recognized in the statement of operations based on their fair value as of the date of grant. Expense is recognized on a straight-line basis over the requisite service period for all awards with service conditions. For performance-based awards, the grant date fair value is recognized as expense when the condition is probable of being achieved, and then on a graded basis over the requisite service period. The Company uses the Black-Scholes option-pricing model to determine the fair value of service-based option awards. The Black-Scholes model requires the use of a number of complex and subjective assumptions including fair value of the underlying security, the expected volatility of the underlying security, a risk-free interest rate and the expected term of the option.

The fair value of restricted stock and RSUs is determined using the closing price of the Company's common stock on the date of grant. All shares of restricted stock are not transferable until vested. Restricted stock is typically issued to non-employee directors and typically vests over a one-year period from the date of issuance. RSUs are issued to employees and typically vest over a three-year period from the date of issuance. The fair value of restricted stock and RSUs upon which vesting is solely service-based is expensed ratably over the vesting period. If the service condition for shares of restricted stock is not met for any reason, the shares of unvested restricted stock will be forfeited and returned to the Company.

For stock options that contain a market condition, the Company uses the Monte-Carlo simulation option-pricing model to determine the fair value of the awards. In addition to the input assumptions used in the Black-Scholes model, the Monte-Carlo simulation option-pricing model factors the probability that the specific market condition may or may not be satisfied into the valuation. Stock-based compensation expense for awards with a market condition is recognized on a straight-line basis over the requisite service period for each such award.

Pursuant to the "evergreen" provisions of the 2014 Employee, Director and Consultant Equity Incentive Plan, the number of shares of common stock authorized for issuance under the plan automatically increased by 486,050 shares to 7,974,980 shares effective January 1, 2020.

Research and Development

Costs incurred in the Company's research and development activities include compensation and related costs, services provided by third-party contractors, materials and supplies and are classified as research and development expenses as incurred. Research and development costs directly associated with research services revenue are classified as research services in cost of revenue.

Earnings per Share

The Company calculates net loss per common share based on the weighted-average number of common shares outstanding during each period. Potential common stock equivalents are determined using the treasury stock method. The weighted-average number of common shares included in the computation of diluted net income (loss) gives effect to all potentially dilutive common equivalent shares, including outstanding stock options and RSUs. Common equivalent shares are excluded from the computation of diluted net loss per share if their effect is antidilutive.

Income Taxes

Income taxes are accounted for under the asset and liability method. Deferred tax assets and liabilities are recognized for the future tax consequences attributable to differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases and operating loss and tax credit carryforwards. Deferred tax assets and liabilities are measured using

enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to be recovered or settled. The effect on deferred tax assets and liabilities of a change in tax rates is recognized in income in the period that includes the enactment date.

The Company recognizes the effect of income tax positions only if those positions are more likely than not of being sustained. The Company accounts for uncertain tax positions using a recognition threshold and measurement attribute for the financial statement recognition and measurement of a tax position taken or expected to be taken in a tax return. Differences between tax positions taken in a tax return and amounts recognized in the financial statements are recorded as adjustments to income taxes payable or receivable, or adjustments to deferred taxes, or both. Changes in recognition or measurement are reflected in the period in which the change in judgment occurs. The Company recognizes penalties and interest related to uncertain tax positions, if any, as a component of income tax expense.

Segments

Operating segments are identified as components of an enterprise about which separate, discrete financial information is available for evaluation by the chief operating decision maker in making decisions on how to allocate resources and assess performance. The Company's chief operating decision maker is the Chief Executive Officer. The Company's chief operating decision maker reviews consolidated operating results to make decisions about allocating resources and assessing performance for the entire Company. The Company presently views its operations and manages its business as one operating segment.

Information about the Company's total revenues, based on shipment destination or services location, is presented in the following table:

	 Year Ended December 31,					
	 2020		2019		2018	
Revenue:						
U.S.	\$ 44,842	\$	58,328	\$	41,733	
International	55,431		81,047		62,628	
Total revenue	\$ 100,273	\$	139,375	\$	104,361	

Recently Issued Accounting Standards

From time to time, new accounting pronouncements are issued by the Financial Accounting Standards Board or other standard setting bodies. Recently issued standards typically do not require adoption until a future effective date. Prior to their effective date, the Company evaluates the pronouncements to determine the potential effects of adoption to its consolidated financial statements.

Standards Implemented Since December 31, 2019

The Company has not implemented any accounting standards that had a material impact on its consolidated financial statements during the year ended December 31, 2020.

Standards to be Implemented After December 31, 2020

The Company believes that the impact of recently issued accounting standards that are not yet effective will not have a material impact on its consolidated financial statements.

(3) Revenue from Contracts with Customers

Revenue Recognition

Revenue is recognized when a customer obtains control of promised goods or services in an amount that reflects the consideration which the entity expects to receive in exchange for those goods or services. To determine revenue recognition for arrangements within the scope of ASC 606, the Company performs the following five steps: (i) identification of the contract with a customer; (ii) identification of the performance obligations in the contract; (iii) determination of the transaction price; (iv) allocation of the transaction price to the separate performance obligations in the contract; and (v) recognition of the revenue associated with

performance obligations as they are satisfied. The Company applies the five-step model to contracts when it is probable that the Company will collect the consideration it is entitled to in exchange for the goods or services it transfers to the customer. At contract inception, once the contract is determined to be within the scope of ASC 606, the Company assesses the goods or services promised within each contract and determines those that are performance obligations, and assesses whether each promised good or service is distinct. If the contract contains a single performance obligation, the entire transaction price is allocated to the single performance obligation. Contracts that contain multiple performance obligations require an allocation of the transaction price based on the estimated relative standalone-selling prices of the promised products or services underlying each performance obligation. The Company determines standalone-selling prices based on the price at which the performance obligation is sold separately. If the standalone-selling price is not observable through past transactions, the Company estimates the standalone-selling price taking into account available information such as market conditions and internally approved pricing guidelines related to the performance obligations. The Company then recognizes as revenue the amount of the transaction price that is allocated to the respective performance obligation when (or as) the performance obligation is satisfied.

When determining the transaction price of a contract, an adjustment is made if payment from a customer occurs either significantly before or significantly after performance, resulting in a significant financing component. Applying the practical expedient in paragraph ASC 606-10-32-18, the Company does not assess whether a significant financing component exists if the period between when the Company performs its obligations under the contract and when the customer pays is one year or less. The Company did not have any contracts outstanding at both December 31, 2019 and December 31, 2018 and did not enter into any contracts during each of the years ended December 31, 2020 and 2019 that contained a significant financing component.

The Company records deferred revenue for product sales when (i) the Company has delivered products but other revenue recognition criteria have not been satisfied or (ii) payments have been received in advance of the completion of required performance obligations.

Shipping and Handling Costs

Shipping and handling costs associated with outbound freight after control over a product has transferred to a customer are accounted for as fulfillment costs and are included in the cost of product revenue. The associated amount of revenue recognized includes the consideration to which the Company expects to be entitled to receive in exchange for incurring these shipping and handling costs.

Product Revenue

The Company generally enters into contracts containing one type of performance obligation. The Company recognizes product revenue when the performance obligation is satisfied, which is generally upon delivery according to contractual shipping terms within customer purchase orders.

The Company also enters into rebate agreements with certain customers. These agreements may be considered an additional performance obligation of the Company or variable consideration within a contract. Rebates are recorded as a reduction of revenue in the period the related product revenue is recognized. A corresponding liability is recorded as a component of deferred revenue on the consolidated balance sheets. These arrangements are primarily based on the customer attaining contractually specified sales volumes.

The Company estimates the amount of its product sales that may be returned by its customers and records this estimate as a reduction of revenue in the period the related product revenue is recognized. The Company currently estimates product return liabilities using historical rates of return, current quarter credit sales, and specific items of exposure on a contract-by-contract basis. Sales return reserves were approximately \$0.1 million at both Decembers 31, 2020 and December 31, 2019.

Subsea Projects

The Company manufactures and sells subsea products that are designed for pipe-in-pipe applications in offshore oil production and are typically customized to meet customer specifications. Subsea products typically have no alternative use and contain an enforceable right to payment. Customer invoicing terms for subsea products are typically based on certain milestones within the production and delivery schedule. Under the provisions of ASC 606, the Company recognizes revenue at a point in time when transfer of control of the products is passed to the customer, or over time utilizing the input method. The timing of revenue recognition is assessed on a contract-by-contract basis. During the years ended December 31, 2020, 2019, and 2018 the Company recognized revenue of \$9.7 million, \$17.0 million, and \$8.1 million respectively, in connection with subsea projects.

Research Services

The Company performs research services under contracts with various government agencies and other institutions. These contracts generally have one type of performance obligation associated with the provision of research services including certain licenses to any resulting intellectual property. The Company records revenue using the percentage-of-completion method in two ways: (1) for firm-fixed-price contracts, the Company accrues that portion of the total contract price that is allocable on the basis of the Company's estimates of costs incurred to date to total contract costs; and (2) for cost-plus-fixed-fee contracts, the Company records revenue that is equal to total payroll cost incurred times a stated factor plus reimbursable expenses, to a stated upper limit. The primary cost under the Company's research service contracts is the labor expended in completing the research. Typically, the only deliverable, other than the labor hours expended, is reporting research results to the customer or delivery of research grade aerogel products. Because the input measure of labor hours expended is also reflective of the output measure, it is a reliable means to measure the extent of progress toward completion. Revisions in cost estimates and fees during the course of the contract are reflected in the accounting period in which the facts that require the revisions become known. Contract costs and rates used to allocate overhead to contracts are subject to audit by the respective contracting government agency. Adjustments to revenue as a result of audit are recorded within the period they become known. To date, adjustments to revenue as a result of contracting agency audits have been insignificant.

Disaggregation of Revenue

In the following tables, revenue is disaggregated by primary geographical region and source of revenue:

			ber 31, 2020			
	U.S.		ernational		Total	
		(In t	thousands)			
Ф.		Φ.	20.402	Φ.	20.402	
\$	_	\$		\$	38,403	
	_				986	
	-				13,881	
			2,161		2,161	
			<u> </u>	_	44,842	
\$	44,842	\$	55,431	\$	100,273	
\$	42,416	\$	47,678	\$	90,094	
	1,987		7,753		9,740	
	439		_		439	
\$	44,842	\$	55,431	\$	100,273	
		Dece	mber 31, 2019			
	U.S.	In	ternational		Total	
	U.S.		ternational thousands)		Total	
	U.S.	(In	thousands)			
\$	U.S.		thousands) 44,485	\$	44,485	
\$	U.S	(In	thousands) 44,485 9,064	\$	44,485 9,064	
\$	U.S	(In	thousands) 44,485	\$	44,485 9,064 24,081	
\$	U.S	(In	thousands) 44,485 9,064	\$	44,485 9,064 24,081	
	U.S. — — — — — — 58,328	(In	thousands) 44,485 9,064 24,081	\$	44,485 9,064 24,081 3,417	
\$		(In	thousands) 44,485 9,064 24,081	\$	44,485 9,064 24,081 3,417 58,328	
		(In	44,485 9,064 24,081 3,417		44,485 9,064 24,081 3,417 58,328	
\$	58,328 58,328	(In	44,485 9,064 24,081 3,417 — 81,047	\$	44,485 9,064 24,081 3,417 58,328 139,375	
	58,328 58,328 52,050	(In	thousands) 44,485 9,064 24,081 3,417 — 81,047		44,485 9,064 24,081 3,417 58,328 139,375	
\$	58,328 58,328 52,050 3,837	(In	44,485 9,064 24,081 3,417 — 81,047	\$	44,485 9,064 24,081 3,417 58,328 139,375	
\$	58,328 58,328 52,050	(In	thousands) 44,485 9,064 24,081 3,417 — 81,047	\$	44,485 9,064	
	\$ \$ \$	\$ ————————————————————————————————————	\$ — \$ — 44,842 \$ — \$ — 44,842 \$ — \$ — 44,842 \$ — \$ — 44,842 \$ — \$ — 439 \$ — 44,842 \$ — 6 — 6 — 6 — 6 — 6 — 6 — 6 — 6 — 6 —	(In thousands) \$ — \$ 38,403 — 986 — 13,881 — 2,161 44,842 — \$ 44,842 \$ 55,431 \$ 42,416 \$ 47,678 1,987 7,753 439 —	(In thousands) \$ 38,403 \$ — 986 — 13,881 — 2,161 — 2,161 44,842 — — \$ 44,842 \$ 55,431 \$ 1,987 7,753 439 — — \$ 44,842 \$ 55,431 \$ 55,431 \$	

	December 31, 2018							
		U.S.	Int	ernational		Total		
			(In	thousands)				
Geographical region								
Asia	\$	_	\$	34,597	\$	34,597		
Canada		_		4,749		4,749		
Europe		_		19,905		19,905		
Latin America		_		3,377		3,377		
U.S.		41,733		_		41,733		
Total revenue	\$	41,733	\$	62,628	\$	104,361		
Source of revenue								
Product revenue	\$	39,490	\$	54,487	\$	93,977		
Subsea projects		5		8,141		8,146		
Research services		2,238		_		2,238		
Total revenue	\$	41,733	\$	62,628	\$	104,361		

Contract Balances

The following table presents changes in the Company's contract assets and contract liabilities during the year ended December 31, 2020:

	Dec	lance at ember 31,				D	Balance at ecember 31,
	-	2019	Additions]	Deductions		2020
			(In tho	usand	s)		
Contract assets							
Subsea projects	\$	2,811	\$ 9,424	\$	(10,865)	\$	1,370
Research services		172	207		(312)		67
Total contract assets	\$	2,983	\$ 9,631	\$	(11,177)	\$	1,437
Contract liabilities							
Deferred revenue							
Product revenue	\$	4,991	\$ 1,162	\$	(4,294)	\$	1,859
Subsea projects		491	4,835		(5,148)		178
Research services		138	94		(232)		_
Prepayment liability		9,786	_		(231)		9,555
Total contract liabilities	\$	15,406	\$ 6,091	\$	(9,905)	\$	11,592

During the year ended December 31, 2020, the Company recognized \$4.6 million of revenue that was included in deferred revenue at December 31, 2019.

A contract asset is recorded when the Company satisfies a performance obligation by transferring a promised good or service and has earned the right to consideration from its customer. These assets may represent a conditional or unconditional right to consideration and are included within accounts receivable on the consolidated balance sheets.

A contract liability is recorded when consideration is received, or such consideration is unconditionally due, from a customer prior to transferring goods or services under the terms of the contract. Contract liabilities are recognized as revenue after control of the products or services is transferred to the customer and all revenue recognition criteria have been met.

(4) Inventories

Inventories consist of the following:

	 December 31,				
	 2020	- 2	2019		
	(In thousands)				
Raw material	\$ 4,068	\$	4,334		
Finished goods	9,031		4,434		
Total	\$ 13,099	\$	8,768		

(5) Property, Plant and Equipment, Net

Property, plant and equipment consist of the following:

	 Decem			
	 2020		2019	Useful life
	(In tho	usands)	
Construction in progress	\$ 1,906	\$	1,309	_
Buildings	24,016		24,016	30 years
Machinery and equipment	124,807		122,485	3 — 10 years
Computer equipment and software	8,850		8,556	3 years
Total	 159,579		156,366	
Accumulated depreciation and amortization	(112,840)		(102,749)	
Property, plant and equipment, net	\$ 46,739	\$	53,617	

Depreciation expense was \$10.2 million, \$10.2 million and \$10.8 million for the years ended December 31, 2020, 2019 and 2018, respectively.

Construction in progress totaled \$1.9 million and \$1.3 million at December 31, 2020 and 2019, respectively, associated with the Company's East Providence, Rhode Island facility.

(6) Accrued Expenses

Accrued expenses consist of the following:

	<u></u>	December 31,				
	203	20		2019		
		(In thousands)				
Employee compensation	\$	2,587	\$	6,472		
Other accrued expenses		1,297		1,585		
Total	\$	3,884	\$	8,057		

(7) Revolving Line of Credit

The Company is party to an Amended and Restated Loan and Security Agreement with Silicon Valley Bank (Loan Agreement). On March 3, 2020, the Loan Agreement was amended to extend the maturity date of the revolving credit facility to April 28, 2021. The Company further amended the Loan Agreement to revise the minimum Adjusted EBITDA financial convent on September 25, 2020 and to secure a preemptive waiver of the Adjusted EBITDA financial convent on December 24, 2020, among other things. On March 12, 2021, the Loan Agreement was amended and restated to extend the maturity date of the revolving credit facility to April 28, 2022 and to establish certain minimum Adjusted EBITDA levels and minimum Adjusted Quick Ratio covenants, as defined.

Under the revolving credit facility, the Company is permitted to borrow a maximum of \$20.0 million, subject to continued covenant compliance and borrowing base requirements. The interest rate applicable to borrowings under the revolving credit facility is based on prime rate, subject to a minimum rate of 4.00% per annum. Prime rate-based rates vary from prime rate plus 0.75% per annum to prime rate plus 2.00% per annum. In addition, the Company is required to pay a monthly unused revolving line facility fee of 0.50% per annum of the average unused portion of the revolving credit facility.

Under the Loan Agreement, the Company is required to comply with both non-financial and financial covenants, including a minimum Adjusted EBITDA covenant, as defined. At December 31, 2020, the Company was in compliance with all such covenants. Obligations under the Loan Agreement are secured by a security interest in all assets of the Company, including those at the East Providence facility, except for certain exclusions. The Company intends to extend or replace the facility prior to its maturity.

During the year ended December 31, 2020, the Company borrowed \$19.4 million and repaid \$22.6 million under the line of credit. At December 31, 2020 the Company had no amounts drawn from the revolving credit facility. At December 31, 2019 the Company had \$3.1 million drawn from the revolving credit facility.

The Company has provided letters of credit to secure obligations under certain commercial contracts and other obligations. The Company had outstanding letters of credit backed by the revolving credit facility of \$1.4 million and \$0.9 million at December 31, 2020 and 2019, respectively, which reduce the funds otherwise available to the Company under the facility.

At December 31, 2020, the amount available to the Company under the revolving credit facility was \$5.4 million after giving effect to the \$1.4 million of outstanding letters of credit.

(8) Debt

On May 1, 2020, Aspen Aerogels Rhode Island, LLC (Borrower) executed a promissory note (Note) in favor of Northeast Bank to receive an unsecured loan in the principal amount of \$3.7 million (the PPP Loan) pursuant to the Paycheck Protection Program (PPP) established by the CARES Act, as amended by the Paycheck Protection Program Flexibility Act (Flexibility Act), and administered by the SBA. The Borrower conferred with representatives of the SBA prior to finalizing the PPP Loan. The PPP Loan was subsequently sold by Northeast Bank to The Loan Source, Inc. (PPP Investor), a secondary market investor.

The PPP Loan carries an interest rate of 1% per year and matures two years from the date of the Note. The PPP Loan indebtedness may be forgiven in whole or in part upon application by the Borrower to the PPP Investor. The PPP Investor will determine to what extent the PPP Loan is eligible for forgiveness, subject to SBA guidelines and other regulations, based on the use of loan proceeds for payroll costs, payment of interest on covered mortgage obligations, rent and utility costs over either an eight-week or 24-week period, at the Borrower's option, following the Borrower's receipt of the loan proceeds. Upon the Borrower's application for forgiveness, the SBA will review the Borrower's eligibility, use of proceeds and other certifications in connection with the application for the PPP Loan. Upon such review, the SBA may approve or deny the Borrower's loan forgiveness application, in whole or in part. As of December 31, 2020, the Borrower had not applied for forgiveness.

If the Borrower has not applied for forgiveness within ten months from the end of the 24-week period following receipt of the loan proceeds, the Borrower will be required make payments of principal and accrued interest in equal monthly installments over the remaining term of the loan. In addition, the Flexibility Act permits the Borrower and the PPP Investor to mutually agree to extend the term of the PPP Loan to five years from the date of the Note. The Borrower may repay the PPP Loan at any time without penalty.

While the Borrower is not required to apply for forgiveness of the PPP Loan, upon application for forgiveness, the Borrower may not receive forgiveness of the PPP Loan in whole or in part. In addition, the amount of potential loan forgiveness may be reduced if the Borrower failed to maintain employee and salary levels during the applicable eight-week or 24-week period following receipt of the loan proceeds. If the Borrower applies for forgiveness, and the PPP Loan is not forgiven in whole or in part, the Borrower will be required to make payments of principal and accrued interest in equal monthly installments over the remaining term of the loan for the post-forgiveness balance outstanding.

The Note contains customary events of default relating to, among other things, payment defaults, breaches of representations and warranties, and defaults under any loan or agreement with another debtor, including the Company's credit facility with SVB, to the extent the PPP Investor believes such default may materially affect the Borrower's ability to repay the PPP Loan. The occurrence of an event of default, if not cured, may result in the Borrower's repayment of the PPP Loan prior to maturity.

The Borrower has used the proceeds of the PPP Loan to support ongoing operations and to sustain staffing levels in its East Providence, Rhode Island manufacturing facility despite the unfavorable impact of the COVID-19 pandemic and volatile energy markets on its business.

Long-term debt consists of the following:

	December 3 2020	31, D	ecember 31, 2019
		(In thousands	s)
Long-term debt, principal	\$ 3	,686 \$	_
Current portion of long-term debt	(1	,609)	_
Debt issuance costs, net of accumulated amortization		(18)	_
Long-term debt	\$ 2	2,059 \$	

The schedule of required principal payments remaining on long-term debt outstanding as of December 31, 2020 is as follows:

Year	Principal Payments
	(In thousands)
2021	1,609
2022	2,077
Total principal payments	\$ 3,686

(9) Interest Expense, net

For the years ended December 31, 2020, 2019, and 2018, interest expense, net was \$0.2 million, \$0.4 million, and \$0.5 million, respectively, and consisted primarily of fees and interest expense related to the Company's revolving credit facility with Silicon Valley Bank.

(10) Leases

The Company leases office and warehouse space in Northborough, Massachusetts and East Providence, Rhode Island under operating leases. Under these agreements, the Company is obligated to pay annual rent, real estate taxes, and certain other operating expenses. The Company also leases equipment under operating leases. The Company's operating leases expire at various dates through 2026.

On January 1, 2019, the Company adopted ASU 2016-02 which modified the accounting for leases and required that all leases be recorded on the consolidated balance sheets as assets and liabilities. The Company adopted this standard using the modified retrospective transition approach with the effective date as the date of initial application. The Company also elected the package of practical expedients under the new standard, which permitted the Company to not reassess prior conclusions about lease identification, lease classification, and initial direct costs. In addition, the Company elected the short-term lease recognition exemption under which the Company will not recognize ROU assets or lease liabilities for all leases that qualify. The Company also elected the practical expedient to not separate non-lease components from the associated lease components for all of its equipment leases.

The Company determines if an arrangement is a lease at inception. ROU assets represent the Company's right to use an underlying asset for the lease term and lease liabilities represent the Company's payment obligations under the lease. Operating lease ROU assets and liabilities are recognized based on the present value of lease payments over the lease term. To measure its lease liabilities, the Company uses its incremental borrowing rate or the rate implicit in the lease, if available. The Company calculates its incremental borrowing rate using a synthetic credit rating analysis based on Moody's Building Materials Industry Rating Methodology. ROU assets also include any direct costs and prepaid lease payments but exclude any lease incentives received. The Company's lease term may include options to extend or terminate the lease when it is reasonably certain that the Company will exercise that option. Lease expense for lease payments is recognized on a straight-line basis over the lease term.

The Company elected the short-term lease recognition exemption for all leases that qualify. For leases that qualify for this exemption, the Company does not recognize ROU assets or lease liabilities. For lease agreements with lease and non-lease components, the Company accounts for each component separately. However, in the case of equipment leases, the Company accounts for lease and non-lease components as a single component.

Upon adoption of ASU 2016-02 on January 1, 2019, the Company recognized operating lease liabilities of approximately \$6.0 million with corresponding ROU assets of approximately \$4.6 million. Additionally, the Company derecognized deferred rent liabilities of \$1.4 million. Maturities of operating lease liabilities at December 31, 2020 are as follows:

Year	Operating Leases
	(In thousands)
2021	1,359
2022	1,249
2023	1,193
2024	684
2025	517
Thereafter	532
Total lease payments	5,534
Less imputed interest	(891)
Total lease liabilities	\$ 4,643

The Company incurred operating lease costs of \$1.4 million and \$1.5 million during the years ended December 31, 2020 and 2019, respectively. Cash payments related to operating lease liabilities were \$1.5 million and \$1.4 million during the years ended December 31, 2020 and 2019, respectively. At December 31, 2020, the weighted average remaining lease term for operating leases was 4.6 years. At December 31, 2020, the weighted average discount rate for operating leases was 7.8%.

As of December 31, 2020, the Company has additional operating equipment leases that will commence during 2021 with total lease payments of \$0.2 million and a weighted average lease term of 4.0 years.

(11) Commitments and Contingencies

Thermal Barrier Contract

The Company is party to a contract with a major U.S. automotive original equipment manufacturer (OEM) to supply fabricated, multi-part thermal barriers (Barriers) for use in the battery system of its next-generation electric vehicles (Contract). Pursuant to the Contract, the Company is obligated to supply Barriers at fixed annual prices and at volumes to be specified by the OEM up to a daily maximum quantity through the term of the agreement, which expires on September 1, 2026. While the OEM has agreed to purchase its requirement for Barriers at locations to be designated from time to time from the Company, it has no obligation to purchase any minimum quantity of Barriers under the Contract. In addition, the OEM may terminate the Contract any time and for any or no reason. All other terms of the Contract are generally consistent with the OEM's standard purchase terms, including customary quality and warranty provisions.

BASF Supply Agreement

The Company is party to a supply agreement, as amended, with BASF Polyurethanes GmbH (BASF) (the Supply Agreement) and a joint development agreement with BASF SE (the JDA). Pursuant to the Supply Agreement, the Company will sell exclusively to BASF certain of the Company's products at annual volumes to be specified by BASF, subject to certain volume limits. However, BASF has no obligation to purchase products under the Supply Agreement. The Supply Agreement will terminate on December 31, 2027 with respect to the Company's Spaceloft A2 product and December 31, 2028 with respect to a new product developed under the JDA. Upon the expiration of the Supply Agreement with respect to each product, the Company will be subject to a post-termination supply commitment for an additional two years. The JDA is designed to facilitate collaboration by the parties on the development and commercialization of new products.

In addition, BASF, in its sole discretion, may make prepayments to the Company in the aggregate amount of up to \$22.0 million during the term of the Supply Agreement. These prepayment obligations are secured by a security interest in real estate, plant and equipment at the Company's Rhode Island facility and a license to certain intellectual property. BASF made a prepayment in the amount of \$5.0 million to the Company in 2018 (the 2018 Prepayment). As of January 1, 2019, 25.3% of any amounts that the Company invoices for Spaceloft A2 sold to BASF are credited against the outstanding balance of the 2018 prepayment. If any of the 2018 Prepayment remains uncredited as of December 31, 2021, BASF may require that the Company repay the uncredited amount to BASF beginning in 2022.

Pursuant to the first addendum to the Supply Agreement, on January 30, 2019, BASF made an additional prepayment in the amount of \$5.0 million to the Company (the 2019 Prepayment). As of January 1, 2020, 50.0% % of any amounts that the Company invoices for the newly developed product sold to BASF are credited against the outstanding balance of the 2019 Prepayment. After December 31, 2022, BASF may require that the Company credit an additional 24.7% of any amounts invoiced by the Company for Spaceloft A2 product sold to BASF against the outstanding balance of the 2019 Prepayment, if any, or may require that the Company repay the uncredited amount of the 2019 Prepayment to BASF in full.

As of December 31, 2020, the Company had received \$10.0 million in prepayments from BASF and applied approximately \$0.2 million of credits against amounts invoiced. The prepayments are recorded on the balance sheet as a prepayment liability, net of the current portion of \$0.3 million and \$0.2 million at December 31, 2020 and 2019, respectively, which is included within deferred revenue. The amounts and terms of additional prepayment installments, if any, are subject to negotiation between the Company and BASF.

Letters of Credit

The Company has provided certain customers with letters of credit securing obligations under commercial contracts. The Company had letters of credit outstanding of \$1.4 million and \$0.9 million at December 31, 2020 and 2019, respectively. These letters of credit are secured by the Company's revolving credit facility (see note 7).

Operating Leases

During 2016, the Company entered into an agreement to extend its lease of approximately 51,650 square feet of office space in Northborough, Massachusetts. The lease commenced on January 1, 2017 and will expire on December 31, 2026. The annual base rent associated with the lease was \$408,000 during 2017 and is increasing by approximately 3% annually for the term of the lease. The lease also requires the payment by the Company of its pro rata share of real estate taxes and certain other expenses. Prior to the expiration of the lease, the Company will have the right to extend the lease for an additional term of three years.

Under the terms of the lease extension, the landlord provided the Company with an allowance of \$1.2 million to be utilized for improvements to the leased premises. These amounts were considered a lease incentive and were excluded from the Company's ROU assets upon its adoption of ASU 2016-02 on January 1, 2019 (see note 10). At December 31, 2020 and 2019, the Company had capitalized \$1.2 million in associated leasehold improvement costs.

The Company also leases facilities and equipment under operating leases expiring at various dates through 2026. Under these agreements, the Company is obligated to pay annual rent, real estate taxes, and certain operating expenses. See note 10 for further information on future minimum lease payments under operating leases at December 31, 2020.

The Company incurred rent expense under all operating leases of approximately \$1.4 million, \$1.5 million and \$1.5 million in the years ended December 31, 2020, 2019 and 2018, respectively.

Federal, State and Local Environmental Regulations

The Company is subject to federal, state and local laws and regulations relating to the environment. These laws generally provide for control of pollutants released into the environment and require responsible parties to undertake remediation. Penalties may be imposed for noncompliance.

During the year ended 2020, the Company was in technical discussions with the U.S. Environmental Protection Agency (EPA) in connection with the EPA's notice of potential violation and opportunity to confer that the Company received regarding the applicability of certain Resource Conservation and Recovery Act (RCRA) provisions to certain aspects of its manufacturing unit operations. The EPA notice was in connection with the EPA's RCRA Compliance Evaluation Inspection of the Company's East Providence, Rhode Island manufacturing facility in May 2019. Subsequent to these initial discussions, the Company received notice from the EPA that there were no violations with respect to its manufacturing unit operations.

Litigation

The Company is, from time to time, a party to litigation that arises in the normal course of its business operations. See Part I, Item 3 ("Legal Proceedings") of this Annual Report on Form 10-K for a description of certain of the Company's current legal proceedings. The Company is not presently a party to any litigation for which it believes a loss is probable requiring an amount to be accrued or a possible loss contingency requiring disclosure.

(12) Stockholders' Equity

At December 31, 2020 and 2019, the Company was authorized to issue 130,000,000 shares of stock, of which 125,000,000 shares were designated as common stock and 5,000,000 shares were designated as preferred stock.

(13) Employee Benefit Plan

The Company sponsors the Aspen Aerogels, Inc. 401(k) Plan. Under the terms of the plan, the Company's employees may contribute a percentage of their pretax earnings. During each of the years ended December 31, 2020, 2019 and 2018, the Company provided matching contributions of \$0.2 million.

(14) Employee Stock Ownership Plans

Effective June 12, 2014, the Company adopted the 2014 Employee, Director and Consultant Equity Incentive Plan (the 2014 Equity Plan). Under the 2014 Equity Plan, the Company may grant incentive stock options (ISOs), non-qualified stock options (NSOs), restricted stock, restricted stock units (RSUs) and other stock-based awards. Stock options under the plan are to be granted with an exercise price not less than the fair market value of the Company's common stock at the date of grant. Equity awards granted to employees generally vest over a service period of three to four years. Restricted stock and stock options granted to nonemployee directors generally vest over a one-year service period.

During 2020, the Company granted 165,430 RSUs with a grant date fair value of \$1.3 million and NSOs to purchase 659,655 shares of common stock with a grant date fair value of \$2.8 million to employees under the 2014 Equity Plan. The RSUs and NSOs granted to employees will vest over a three-year period.

During the year ended December 31, 2020, the Company also granted 45,066 shares of restricted common stock with a grant date fair value of \$0.3 million and NSOs to purchase 58,902 shares of common stock with a grant date fair value of \$0.2 million to its non-employee directors under the 2014 Equity Plan. The restricted common stock and NSOs granted to non-employee directors will vest upon the earlier of the date that is the one-year anniversary of the grant or the day prior to the Company's annual meeting of stockholders to be held in 2021.

On December 11, 2015, the Company issued certain equity grants to its chief executive officer which included 78,125 shares of restricted stock, NSOs to purchase 84,745 shares of common stock vesting solely over three years and NSOs to purchase 370,181 shares of common stock vesting subject to certain common stock price target achievements, as defined, over a three to five-year period (the CEO Options). Collectively, these equity grants had an aggregate fair value of \$2.0 million at the time of grant. The restricted stock award will vest based on achievement of a Company financial performance target for fiscal year 2020.

On August 2, 2017, the Company modified the performance target for the year ending December 31, 2020 with respect to 78,125 shares of restricted stock held by its chief executive officer. In addition, the Company modified the vesting conditions of NSOs to purchase 131,578 and 122,324 shares of common stock held by its chief executive officer to extend the time period to achieve certain common stock price targets by an additional year to four and five years from the date of grant, respectively.

The Company accounted for the extension of the time periods for the achievement of the common stock price target vesting conditions of the NSOs as modifications in determining the stock-based compensation expense to be recognized over the remaining service period. The total incremental compensation expense resulting from the modification was \$0.1 million. The incremental compensation expense associated with these awards will be recognized over the remaining service period of the awards.

On November 7, 2018, the Company modified the vesting conditions of the CEO Options such that in the event of a change in control, all the outstanding NSOs would vest, regardless of whether or not the common stock price target vesting conditions of the NSOs are achieved. The total incremental compensation expense resulting from the modification was approximately \$0.1 million which will be recognized over the remaining term of the options.

On December 10, 2020, the Company modified the vesting conditions of NSOs to purchase 116,279 of common stock held by its chief executive officer to extend the time period to achieve the common stock price target. The Company accounted for the extension of the time period for the achievement of the common stock price target vesting condition of the NSOs as a modification and recognized \$1.1 million of incremental stock compensation expense during the year ended December 31, 2020.

Stock-based compensation is included in cost of sales or operating expenses, as applicable, and consists of the following:

	 Year Ended December 31,						
	 2020		2019		2018		
		(In	thousands)				
Cost of product revenue	\$ 598	\$	573	\$	577		
Research and development expenses	652		506		461		
Sales and marketing expenses	704		629		815		
General and administrative expenses	3,050		2,063		2,449		
Total stock-based compensation	\$ 5,004	\$	3,771	\$	4,302		

At December 31, 2020, 4,298,422 shares of common stock were reserved for issuance upon the exercise or vesting of outstanding stock-based awards granted under the 2014 Equity Plan. In addition, at December 31, 2020, 81,593 shares of common stock were reserved for issuance upon the exercise of outstanding options granted under the Company's 2001 Equity Incentive Plan, as amended (the 2001 Equity Plan). Any cancellations or forfeitures of the options outstanding under the 2001 Equity Plan will result in the shares reserved for issuance upon exercise or such options becoming available for grant under the 2014 Equity Plan. At December 31, 2020, the Company has either reserved in connection with statutory tax withholdings or issued a total of 2,789,478 shares under the 2014 Equity Plan. At December 31, 2020, there were 805,487 shares available for future grant under the 2014 Equity Plan.

Stock Options Valuation and Amortization Method

The fair value of each stock option is estimated as of the date of grant using the Black-Scholes option-pricing model. Key inputs into this formula included expected term, expected volatility, expected dividend yield and the risk-free rate. Each assumption is set forth and discussed below.

The Company used a Monte Carlo Simulation model to estimate the original grant date fair value of the CEO Options as well as the 2017 and 2018 modifications. The simulation model was based on the Black-Scholes option-pricing model and a number of complex assumptions including (i) whether the vesting condition is satisfied within the time-vesting periods, and (ii) the date the common stock price target is met per the terms of the agreement.

For stock options with a service condition, the fair value is amortized on a straight-line basis over the requisite service period of the options, which is generally a three-year vesting period from the date of grant.

Expected Term

The expected term represents the period that the Company's stock-based awards are expected to be outstanding. The Company does not have sufficient historical exercise data to provide a reasonable basis upon which to estimate the expected term. Accordingly, the Company uses the simplified method to calculate the expected term for options granted.

Expected Volatility

Due to the Company's limited historical data, the Company has used an estimated volatility based on the historical volatility of comparable companies with publicly available share prices. In 2020, 2019 and 2018, the expected volatility is primarily based on the weighted average volatility of up to 17 companies with business, financial and market attributes that the Company believes are similar to its own. The Company expects to have sufficient historical share price data for future awards.

Expected Dividend

The Company uses an expected dividend yield of zero. The Company does not intend to pay cash dividends on its common stock in the foreseeable future, nor has it paid dividends on its common stock in the past.

Risk-free Interest Rate

The Company uses a risk-free interest rate based on U.S. Treasury zero-coupon issues with a remaining term equal to the expected life assumed at the date of grant.

Estimated Forfeitures

The Company records the impact of forfeitures of service-based awards under the provisions of ASU 2016-09 at the time an award is forfeited.

Assumptions Utilized

The following information relates to the fair value of the option awards estimated by use of the Black-Scholes option-pricing model:

	Year Ended December 31,						
	2020		2019		2018		
Weighted average assumptions:							
Expected term (in years)	5.96		5.81		5.93		
Expected volatility	52.27%		49.90%		47.68%		
Risk free rate	1.08%		2.44%		2.76%		
Expected dividend yield	0.00%		0.00%		0.00%		
Weighted average fair value:							
Grant-date fair value of options granted	\$ 4.15	\$	1.90	\$	2.29		
Grant-date fair value of options vested	\$ 2.44	\$	2.24	\$	3.29		
Aggregate intrinsic value of options exercised	\$ 1,987,654	\$	— :	\$	_		

During 2020, the Company estimated the fair value of the modified NSOs to purchase 116,279 of common stock held by its chief executive officer by use of the Black-Scholes option-pricing model assuming an expected term of 2.5 years, an expected volatility of 67.23%, a risk-free rate of 0.17% and an expected dividend yield of zero.

Outstanding Options

The following table summarizes information about stock options outstanding:

	Number of Shares	Weighted Average Grant Date Fair Value Per Share		Average Grant Date Fair Value Per Share		Average Grant Date Fair Value Per Share		Average Grant Date Fair Value Per Share		Average Grant Date Fair Value Per Share		Average Grant Date Fair Value Per Share		Average Grant Date Fair Value Per Share		Weighted Average Exercise Price Per Share		Weighted Average Remaining Contractual Term (Years)	Aggregate Intrinsic Value
		(\$	in thousands,	exce	pt share and per	r share data)													
Options outstanding at December 31, 2019	3,547,434	\$	5.36	\$	8.13	6.74	\$ 7,908,311												
Granted	718,557	\$	4.15	\$	8.38														
Forfeited	(100,931)	\$	9.40	\$	13.32														
Expired	(16)	\$	5,033.64	\$	10,260.63														
Exercised	(460,600)	\$	2.85	\$	5.78		\$ 1,987,654												
Options outstanding at December 31, 2020	3,704,444	\$	5.33	\$	8.28	6.48	\$ 36,830,172												
Exercisable at December 31, 2020	2,473,684	\$	6.39	\$	9.01	5.41	\$ 24,226,000												
Expected to vest at December 31, 2020	1,230,760	\$	3.19	\$	6.45	2.00	\$ 12,604,172												

As of December 31, 2020, total unrecognized compensation cost related to non-vested service-based options granted under the 2014 Equity Plan was \$2.6 million. The unrecognized compensation cost for the service-based options is expected to be recognized over a weighted average period of 2.00 years.

Restricted Stock Awards and Restricted Stock Units

The Company values restricted stock awards and RSUs based on the closing price of our shares on the date of grant. RSUs have time-based vesting conditions and typically vest over three or four years. Restricted stock awards issued to nonemployee directors generally vest in full one year from the date of grant.

Information related to grants of RSUs during 2020 is as follows:

	Restricted Stock Units	Average Grant Date Fair Value
Balance at December 31, 2019	1,083,000	\$ 4.01
Granted	165,430	8.00
Vested	(497,844)	4.10
Forfeited	(75,014)	4.47
Balance at December 31, 2020	675,572	\$ 4.88

Waighted

Restricted stock awards granted during 2020 are considered issued and outstanding common stock and are excluded from the table above. As of December 31, 2020 there were 123,191 shares of restricted stock outstanding.

The total intrinsic value of restricted stock and RSUs that vested in 2020 and 2019 was \$4.0 million and \$1.5 million, respectively. As of December 31, 2020, 720,638 of the total shares of restricted stock and RSUs outstanding will vest upon the fulfillment of service conditions.

As of December 31, 2020, total unrecognized compensation cost related to restricted stock awards of \$0.1 million, and RSUs of \$1.8 million is expected to be recognized over a weighted average period of 0.46 years and 1.60 years respectively.

(15) CARES Act Payroll Tax Deferral

The Company elected to defer approximately \$0.9 million of its employer payroll tax obligation for the period from March 27, 2020 to December 31, 2020 pursuant to the provisions of the CARES Act. The Company is required to remit 50 percent of the deferred tax balance as of December 31, 2020 on or before December 31, 2021 and the remaining 50 percent on or before December 31, 2022.

Other long-term liabilities consist of the following:

	December 2020	31,
	(In thousa	nds)
Deferred employer payroll tax obligation	\$	870
Current portion of deferred payroll tax obligation		(436)
Other long-term liabilities	\$	434

(16) Net Loss Per Share

The computation of basic and diluted net loss per share consists of the following:

	Year ended December 31,					
	2020	2019	2018			
	(In thousands, except share and per share data					
Numerator:						
Net loss	\$ (21,809)	\$ (14,565)	\$ (34,440)			
Denominator:						
Weighted average shares outstanding, basic and diluted	26,377,652	24,099,438	23,738,852			
Net loss per share, basic and diluted	\$ (0.83)	\$ (0.60)	\$ (1.45)			

On February 18, 2020, the Company completed an underwritten public offering of 1,955,000 shares of its common stock at an offering price of \$8.25 per share. The Company also completed the sale of 714,357 shares at an average price of \$13.96 per share through its at-the-market offering between November 11, 2020 and December 31, 2020.

Potentially dilutive common shares that were excluded from the computation of diluted net loss per share because they were anti-dilutive consist of the following:

	Year ended December 31,				
	2020	2019	2018		
Common stock options	3,704,444	3,547,434	2,994,452		
Restricted common stock units	675,572	1,083,000	875,227		
Restricted common stock awards	123,191	128,453	136,187		
Total	4,503,207	4,758,887	4,005,866		

In the table above, anti-dilutive shares consist of those common stock equivalents that have (i) an exercise price above the average stock price for the period or (ii) related average unrecognized stock compensation expense sufficient to buy back the entire amount of shares. The Company excludes the shares issued in connection with restricted stock awards from the calculation of basic weighted average common shares outstanding until the restrictions lapse.

For each of the years ended December 31, 2020, 2019 and 2018, there was no dilutive impact of the common stock options, RSUs, and restricted stock awards.

(17) Income Taxes

The Company incurred net operating losses and recorded a full valuation allowance against net deferred assets for all periods presented. Accordingly, the Company has not recorded a provision for federal or state income taxes.

The reconciliation between the U.S. statutory income tax rate and the Company's effective rate consists of the following:

	Year Ended December 31,				
	2020	2019	2018		
U.S. federal income tax statutory rate	21%	21%	21%		
Permanent differences	2%	(2)%	0%		
State tax, net of federal benefit	4%	0%	2%		
Changes in valuation allowance for deferred tax assets	(26)%	(18)%	(22)%		
Stock-based compensation	(1)%	(1)%	%		
Expiring net operating losses	(1)%	%	0%		
Other	1%	0%	(1)%		
Effective tax rate					

The tax effects of temporary differences between financial statement and tax accounting that gave rise to significant portions of the Company's deferred tax assets and deferred tax liabilities at December 31, 2020 and 2019 are presented below:

	December 31,			
		2020	2019	
	(In thousands)			
Deferred tax assets:				
Net operating loss carryforwards	\$	58,120	\$ 53,859	
Stock-based compensation		5,345	5,261	
Operating lease liabilities		1,179	1,356	
Tax credit carryforwards		289	289	
Reserves and accruals		687	423	
Interest expense limitation		297	235	
Total gross deferred tax assets		65,917	61,423	
Deferred tax liabilities:				
Depreciation		(2,948)	(3,883)	
Operating lease right-of-use assets		(883)	(1,025)	
Total deferred tax liabilities		(3,831)	(4,908)	
Total deferred tax assets and liabilities		62,086	56,515	
Valuation allowance		(62,086)	(56,515)	
Net deferred tax asset	\$	_	\$	

The CARES Act made several changes to the Internal Revenue Code. The changes include, but are not limited to, increasing the limitation on the amount of deductible interest expense, allowing companies to carryback certain net operating losses and increasing the amount of net operating loss carryforwards that corporations can use to offset taxable income. The tax law changes in the CARES Act did not have a material impact on the Company's income tax provision.

The net change in the valuation allowance for the year ended December 31, 2020, was an increase of \$5.6 million. The Company has recorded a full valuation allowance against its deferred tax assets due to the uncertainty associated with the utilization of the net operating loss carryforwards and other future deductible items. In assessing the realizability of deferred tax assets, the Company considers all available evidence, historical and prospective, with greater weight given to historical evidence, in determining whether it is more likely than not that some portion or all of the deferred tax assets will not be realized. The ultimate realization of the Company's deferred tax assets generally is dependent upon generation of future taxable income.

At December 31, 2020, the Company had \$250.6 million of net operating losses available to offset future federal income, if any, of which \$194.6 million expire on various dates through December 31, 2037. Net operating losses of \$56.0 million generated during the three years ended December 31, 2020 have an unlimited carryforward.

At December 31, 2020, the Company has \$90.1 million of apportioned net operating losses available to offset future state taxable income, if any, and which begin to expire at various dates between 2021 and 2040.

For each of the years ended December 31, 2020, 2019, and 2018, the Company did not have any material unrecognized tax benefits and thus no interest and penalties related to unrecognized tax benefits were recorded. In addition, the Company does not expect that the amount of unrecognized tax benefits will change significantly within the next twelve months.

The Company files a federal income tax return in the United States and income tax returns in various state and foreign jurisdictions. All tax years are open for examination by the taxing authorities for both federal and state purposes.

(18) Subsequent Events

The Company has evaluated subsequent events through March 12, 2021, the date of issuance of the consolidated financial statements for the year ended December 31, 2020.

During the period from January 1, 2021 to March 9, 2021, the Company issued 277,489 shares of its common stock at an average price of \$20.92 per share through its at-the-market offering and received net proceeds of \$5.6 million after deducting commissions of \$0.2 million.

On March 12, 2021, the Company's revolving credit facility with Silicon Valley Bank was amended and restated to extend the maturity date of the revolving credit facility to April 28, 2022. Pursuant to the amendment, the Company is permitted to borrow a maximum of \$20.0 million, subject to continued covenant compliance and borrowing base requirements. The interest rate applicable to borrowings under the revolving credit facility is based on the prime rate, subject to a minimum rate of 4.00% per annum. Prime rate-based rates vary from prime rate plus 0.75% per annum to prime rate plus 2.00% per annum. In addition, the Company is required to pay a monthly unused revolving line facility fee of 0.50% per annum of the average unused portion of the revolving credit facility. The credit facility has also been amended to establish certain minimum Adjusted EBITDA and minimum Adjusted Quick Ratio covenants, as defined.

QUARTERLY RESULTS OF OPERATIONS

		Three Months Ended								
	<u> </u>	March 31,	131, June 30,		Sept 30,			Dec 31,		
		(in thousands, except per share data) (unaudited)								
2020										
Total revenue	\$	28,4	19 \$	24,641	\$	24,195	\$	23,018		
Gross profit		5,9	80	2,851		1,900		3,863		
Loss from operations		(3,0	86)	(5,648)		(6,704)		(6,131)		
Net loss		(3,1	59)	(5,698)		(6,753)		(6,189)		
Net loss per share basic and diluted										
common share - basic	\$	(0.	13) \$	(0.21)	\$	(0.25)	\$	(0.23)		
2019										
Total revenue	\$	27,9	12 \$	29,533	\$	35,425	\$	46,505		
Gross profit		3,7	18	3,514		7,742		11,310		
Loss from operations		(5,9	51)	(5,215)		(2,153)		(830)		
Net loss		(6,0	02)	(5,318)		(2,289)		(956)		
Net loss per share basic and diluted										
common share - basic	\$	(0	25) \$	(0.22)	\$	(0.09)	\$	(0.04)		

Schedule II VALUATION AND QUALIFYING ACCOUNTS (in thousands)

Description	Be	alance at ginning f Year	Charges to Costs and Expenses (a)	Recoveries of Costs and Expenses (b)	Deductions to Allowances for Uncollectible Accounts (c)	s (Deductions from) le Other		Balance at End of Year
Year Ended December 31, 2020:								
Allowances for uncollectible accounts and sales returns and allowances	\$	144	325	_	_	(27)	\$	442
Year Ended December 31, 2019:								
Allowances for uncollectible accounts and sales returns and allowances	\$	2,877	_	(228)	(2,552)	47	\$	144
Year Ended December 31, 2018:								
Allowances for uncollectible accounts and sales returns and allowances	\$	93	2,961	(39)	(142)	4	\$	2,877

- (a) Represents allowances for uncollectible accounts established through general and administrative expenses.
- (b) Represents recoveries of allowances for uncollectible accounts established through general and administrative expenses.
- (c) Represents actual write-offs of uncollectible accounts.
- (d) Represents net change in allowances for sales returns, recorded as contra-revenue.

Item 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE

Not applicable.

Item 9A. CONTROLS AND PROCEDURES

(a) Evaluation of Disclosure Controls and Procedures. We maintain disclosure controls and procedures that are designed to ensure that information required to be disclosed in the reports that we file or submit under the Securities Exchange Act of 1934, as amended, or the Exchange Act, is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms and is accumulated and communicated to our management, including our principal executive officer and principal financial officer, or persons performing similar functions, as appropriate to allow timely decisions regarding required disclosure.

As of December 31, 2020, our management, with the participation of our principal executive officer and principal financial officer, evaluated the effectiveness of our disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act). Our management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving their objectives, and management necessarily applies its judgment in evaluating the cost-benefit relationship of possible controls and procedures. Based on such evaluation, our principal executive officer and principal financial officer have concluded, that, as of December 31, 2020, our disclosure controls and procedures were effective to ensure that information required to be disclosed by us in the reports that we file or submit under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms, and is accumulated and communicated to our management, including our principal executive officer and principal financial officer, or persons performing similar functions, as appropriate to allow timely decisions regarding required disclosure. In addition, our principal executive officer and principal financial officer have concluded that the impact of the COVID-19 pandemic did not impact our ability to maintain our internal controls over financial reporting and disclosure controls and procedures.

(b) Management's Report on Internal Control over Financial Reporting. The Company's management is responsible for establishing and maintaining adequate internal control over financial reporting. Internal control over financial reporting is defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act, as a process designed by, or under the supervision of, the Company's principal executive and principal financial officers and effected by the Company's board of directors, management and other personnel to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. The Company's internal control over financial reporting includes those policies and procedures that:

- pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the Company;
- provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally
 accepted accounting principles, and that receipts and expenditures of the Company are being made only in accordance with authorizations of management
 and directors of the Company; and
- provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of the Company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

The Company's management assessed the effectiveness of the Company's internal control over financial reporting as of December 31, 2020. In making this assessment, management used the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) in Internal Control-Integrated Framework (2013).

Based on our assessment, management believes that, as of December 31, 2020, the Company's internal control over financial reporting is effective based on those criteria.

Our independent registered public accounting firm has issued an audit report on our assessment of our internal control over financial reporting. This report appears further below in this Item 9A.

(c) Changes in Internal Controls. There were no changes in our internal control over financial reporting, as such term is defined in Rules 13a-15(f) and 15(d)-15(f) promulgated under the Exchange Act, identified in connection with the evaluation of such internal control that occurred during the fourth quarter of the last fiscal year that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. OTHER INFORMATION

Amendment to SVB Credit Facility

On March 12, 2021, our revolving credit facility with Silicon Valley Bank was amended and restated to extend the maturity date of the revolving credit facility to April 28, 2022. Under our revolving credit facility, we are permitted to borrow a maximum of \$20.0 million, subject to continued covenant compliance and borrowing base requirements. The interest rate applicable to borrowings under the revolving credit facility is based on the prime rate, subject to a minimum rate of 4.00% per annum. Prime rate-based rates vary from prime rate plus 0.75% per annum to prime rate plus 2.00% per annum. In addition, we are required to pay a monthly unused revolving line facility fee of 0.50% per annum of the average unused portion of the revolving credit facility. The credit facility has also been amended to establish certain minimum Adjusted EBITDA levels with respect to the minimum Adjusted EBITDA financial covenant for the extended term as well as to establish minimum Adjusted Quick Ratio covenants. We intend to extend or replace the facility prior to its maturity.

The foregoing description of the second amended and restated loan and security agreement with Silicon Valley Bank is only a summary of its material terms and does not purport to be complete. This summary is qualified in its entirety by reference to the description of the second amended and restated loan and security agreement with Silicon Valley Bank, a copy of which is filed as an exhibit as part of this Annual Report on Form 10-K.

PART III

Item 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

The response to this item is incorporated by reference from the discussion responsive thereto under the captions "Management and Corporate Governance," "Delinquent Section 16(a) Reports," and "Code of Business Conduct and Ethics" in the Company's Proxy Statement for the 2021 Annual Meeting of Stockholders.

Item 11. EXECUTIVE COMPENSATION

The response to this item is incorporated by reference from the discussion responsive thereto under the caption "Executive Officer and Director Compensation" in the Company's Proxy Statement for the 2021 Annual Meeting of Stockholders.

Item 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS

The response to this item is incorporated by reference from the discussion responsive thereto under the captions "Security Ownership of Certain Beneficial Owners and Management," and "Equity Compensation Plan Information" in the Company's Proxy Statement for the 2021 Annual Meeting of Stockholders.

Item 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE

The response to this item is incorporated by reference from the discussion responsive thereto under the captions "Certain Relationships and Related Person Transactions" and "Management and Corporate Governance" in the Company's Proxy Statement for the 2021 Annual Meeting of Stockholders.

Item 14. PRINCIPAL ACCOUNTING FEES AND SERVICES

The response to this item is incorporated by reference from the discussion responsive thereto under the caption "Independent Registered Public Accounting Firm" in the Company's Proxy Statement for the 2021 Annual Meeting of Stockholders.

PART IV

Item 15. EXHIBITS, FINANCIAL STATEMENT SCHEDULES

Item 15(a). The following documents are filed as part of this Annual Report on Form 10-K:

Item 15(a)(1). The following consolidated financial statements of the Company are included in Part II, Item 8 of this Annual Report on Form 10-K:

Report of Independent Registered Public Accounting Firm

Consolidated Balance Sheets as of December 31, 2020 and 2019

Consolidated Statements of Operations for the Years Ended December 31, 2020, 2019, and 2018

Consolidated Statements of Stockholders' Equity for the Years Ended December 31, 2020, 2019 and 2018

Consolidated Statements of Cash Flows for the Years Ended December 31, 2020, 2019 and 2018

Notes to Consolidated Financial Statements

Item 15(a)(2). The following financial statements schedule is included in Part II, Item 8:

Schedule II - Valuation and Qualifying Accounts

All other financial statement schedules have not been included because they are not applicable or the information is included in the financial statements or notes thereto.

Item 15(a)(3). Exhibits:

The following is a list of exhibits filed as part of this Annual Report on Form 10-K.

Exhibit Number	Exhibit Description	Filed with this Report	Incorporated by Reference herein from Form or Schedule	Filing Date	SEC File/Reg. Number
3.1	Restated Certificate of Incorporation of the Registrant, as filed with the Secretary of State of the State of Delaware on June 18, 2014.		Form 8-K (Exhibit 3.2)	6/19/14	001-36481
3.2	Restated Bylaws of Aspen Aerogels, Inc.		Form 8-K (Exhibit 3.3)	6/19/14	001-36481
4.1	Form of common stock certificate.		Amendment No. 1 to Form S-1 (Exhibit 4.1)	5/14/14	333-195523
4.2	Sixth amended and restated registration rights agreement, dated as of June 11, 2012, by and among the Registrant and the investors named therein, as amended.		Form S-1 (Exhibit 4.8)	4/28/14	333-195523
4.3	Description of Securities.		Form 10-K (Exhibit 4.3)	3/6/20	001-36481
9.1	Letter agreement, dated as of June 11, 2014, by and between the Registrant and the Fidelity Funds.		Amendment No. 5 to Form S-1 (Exhibit 9.1)	6/12/14	333-195523
10.1	2001 equity incentive plan, as amended. +		Form S-1 (Exhibit 10.1.1)	4/28/14	333-195523
10.2	Form of incentive stock option agreement granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.2)	4/28/14	333-195523
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Exhibit Number	Exhibit Description	Filed with this Report	Incorporated by Reference herein from Form or Schedule	Filing Date	SEC File/Reg. Number
10.3	Form of 2013 incentive stock option agreement for options issued in exchange for the forfeiture of options granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.3)	4/28/14	333-195523
10.4	Form of 2013 performance-based incentive stock option agreement granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.4)	4/28/14	333-195523
10.5	Form of non-qualified stock option agreement granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.5)	4/28/14	333-195523
10.6	Form of 2013 non-qualified stock option agreement for options issued in exchange for the forfeiture of options granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.6)	4/28/14	333-195523
10.7	Form of 2013 performance-based non-qualified stock option agreement granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.7)	4/28/14	333-195523
10.8	Form of 2013 independent director stock option agreement for options issued in exchange for the forfeiture of options granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.8)	4/28/14	333-195523
10.9	Form of 2013 performance-based independent director stock option agreement granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.9)	4/28/14	333-195523
10.10	2014 employee, director and consultant equity incentive plan. +		Form S-8 (Exhibit 99.10)	8/13/14	333-198124
10.11	Form of stock option agreement granted under 2014 employee, director and consultant equity incentive plan.+		Amendment No. 1 to Form S-1 (Exhibit 10.2.2)	5/14/14	333-195523
10.12	Form of restricted stock unit agreement for executive officers under 2014 employee, director and consultant equity incentive plan. +		Form 10-Q (Exhibit 10.3)	11/7/14	001-36481
10.13	Form of restricted stock agreement for directors under 2014 employee, director and consultant equity incentive plan. +		Amendment No. 1 to Form S-1 (Exhibit 10.2.3)	5/14/14	333-195523
10.14	Multi-tenant industrial net lease, dated August 20, 2001, by and between the Registrant and Cabot II — MA1M03, LLC (as successor landlord to TMT290 Industrial Park, Inc.), as amended.		Form S-1 (Exhibit 10.3)	4/28/14	333-195523
10.15	Amended and Restated Loan and Security Agreement dated September 3, 2014 and effective as of August 31, 2014, by and between the Company and Silicon Valley Bank.		Form 8-K (Exhibit 10.1)	9/9/14	001-36481
10.15.1	Consent and First Amendment to the Amended and Restated Loan and Security Agreement, dated August 19, 2016, by and between the Registrant and Silicon Valley Bank.		Form 10-Q (Exhibit 10.1)	11/3/16	001-36481
10.15.2	Second Amendment to the Amended and Restated Loan and Security Agreement, dated November 23, 2016, by and between the registrant and Silicon Valley Bank.		Form 10-K (Exhibit 10.15.3)	3/2/17	001-36481
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Exhibit Number	Exhibit Description	Filed with this Report	Reference herein from Form or Schedule	Filing Date	SEC File/Reg. Number
10.15.3	Third Amendment to the Amended and Restated Loan and Security Agreement, dated December 27, 2016, by and between the Registrant and Silicon Valley Bank.		Form 10-K (Exhibit 10.15.4)	3/2/17	001-36481
10.15.4	Fourth Amendment to the Amended and Restated Loan and Security Agreement, dated January 27, 2017, by and between the Registrant and Silicon Valley Bank.		Form 10-Q (Exhibit 10.1)	5/5/17	001-36481
10.15.5	Fifth Amendment to the Amended and Restated Loan and Security Agreement, dated September 27, 2017, by and between the Registrant and Silicon Valley Bank.		Form 10-Q (Exhibit 10.1)	11/3/17	001-36481
10.15.6	Sixth Amendment to the Amended and Restated Loan and Security Agreement, dated January 25, 2018, by and between the Registrant and Silicon Valley Bank.		Form 10-Q (Exhibit 10.1)	5/4/18	001-36481
10.15.7	Seventh Amendment to the Amended and Restated Loan and Security Agreement, dated April 25, 2018, by and between the Registrant and Silicon Valley Bank.		Form 10-Q (Exhibit 10.1)	8/3/18	001-36481
10.15.8	Eighth Amendment to the Amended and Restated Loan and Security Agreement and First Amendment to the Preemptive Forbearance and Conditional Waiver Agreement, dated November 30, 2018, by and between the Registrant and Silicon Valley Bank, further amending a conditional waiver agreement dated August 30, 2018.		Form 10-K (Exhibit 10.15.8)	3/8/19	001-36481
10.15.9	Ninth Amendment to the Amended and Restated Loan and Security Agreement, dated March 4, 2019, by and between the Registrant and Silicon Valley Bank.		Form 10-Q (Exhibit 10.2)	5/3/19	001-36481
10.15.10	Tenth Amendment to the Amended and Restated Loan and Security Agreement, dated March 3, 2020, by and between the Registrant and Silicon Valley Bank.		Form 10-K (Exhibit 10.15.10)	3/6/20	001-36481
10.15.11	Eleventh Amendment to the Amended and Restated Loan and Security Agreement, dated September 5, 2020, by and between the Registrant and Silicon Valley Bank.		Form 10-Q (Exhibit 10.1)	11/5/20	001-36481
10.15.12	Twelfth Amendment to the Amended and Restated Loan and Security Agreement, dated December 24, 2020, by and between the Registrant and Silicon Valley Bank.	X			
10.15.13	Second Amended and Restated Loan and Security Agreement dated March 12, 2021, by and between the Company and Silicon Valley Bank.	X			
10.16	Promissory Note, dated May 1, 2020 by and between Aspen Aerogels Rhode Island, LLC and Northeast Bank.		Form 10-Q (Exhibit 10.1)	5/4/20	001-36481
10.17	Executive agreement, dated as of November 7, 2018, by and between the Registrant and Donald R. Young. +		Form 10-Q (Exhibit 10.2)	11/7/18	001-36481
10.17.1	Amendment to Executive Agreement, dated as of August 1, 2019, by and between the Registrant and Donald R. Young. +		Form 10-Q (Exhibit 10.1)	8/2/19	001-36481
10.17.2	Second Amendment to the Executive Agreement, dated as of January 1, 2020, by and between the Registrant and Donald R. Young. +		Form 10-K (Exhibit 10.16.2)	3/6/20	001-36481
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Incorporated by

Exhibit Number	Exhibit Description	Filed with this Report	Incorporated by Reference herein from Form or Schedule	Filing Date	SEC File/Reg. Number
10.18	Form of executive agreement, dated as of December 21, 2018, by and between the Registrant and each of Messrs. Fairbanks and Whitaker. +		Form 8-K (Exhibit 10.1)	12/21/18	001-36481
10.19	Bonus plan. +		Amendment No. 2 to Form S-1 (Exhibit 10.15)	5/22/14	333-195523
10.20	Form of participation letter of executive officers under bonus plan. +		Form 10-K (Exhibit 10.23)	3/2/17	001-36481
10.21	Non-Employee Director Compensation Policy. +		Form 10-Q (Exhibit 10.1)	11/7/18	001-36481
10.22	Compensation Recoupment Policy.		Form 10-K (Exhibit 10.25)	3/8/19	001-36481
10.23	Cross license agreement dated as of April 1, 2006 by and between Cabot Corporation and the Registrant, as amended.*		Form S-1 (Exhibit 10.17)	4/28/14	333-195523
10.24	Form of indemnification agreement with directors and certain officers. +		Amendment No. 1 to Form S-1 (Exhibit 10.18)	5/14/14	333-195523
10.25	Inducement Agreement, dated February 15, 2016, by and between the Registrant and the Development Authority of Bulloch County, the City of Statesboro, Georgia and Bulloch County, Georgia.		Form 10-Q (Exhibit 10.1)	5/6/16	001-36481
10.26	PILOT Agreement, dated February 15, 2016, by and between the Registrant and the Development Authority of Bulloch County, the City of Statesboro, Georgia and Bulloch County, Georgia.		Form 10-Q (Exhibit 10.2)	5/6/16	001-36481
10.27	Performance and Accountability Agreement, dated February 15, 2016, by and between the Registrant and the Development Authority of Bulloch County, the Georgia Department of Community Affairs and the administering agency for the OneGeorgia Authority.		Form 10-Q (Exhibit 10.3)	5/6/16	001-36481
10.28	Supply Agreement, dated June 21, 2016, by and between the Registrant and BASF SE.*		Form 10-Q (Exhibit 10.1)	8/5/16	001-36481
10.28.1	Amended and Restated Supply Agreement, dated February 16, 2018, by and between the Registrant and BASF SE.*		Form 10-Q (Exhibit 10.2)	5/4/18	001-36481
10.28.2	First Addendum to the Amended and Restated Supply Agreement, dated January 14, 2019, by and between the Registrant and BASF SE.*		Form 10-Q (Exhibit 10.1)	5/3/19	001-36481
10.29	Side Agreement, dated June 21, 2016, by and between the Registrant and BASF SE.*		Form 10-Q (Exhibit 10.2)	8/5/16	001-36481
10.29.1	Amended and Restated Side Agreement, dated February 16, 2018, by and between the Registrant and BASF SE.*		Form 10-Q (Exhibit 10.3)	5/4/18	001-36481
10.30	Joint Development Agreement, dated June 21, 2016, by and between the Registrant and BASF SE.*		Form 10-Q (Exhibit 10.3)	8/5/16	001-36481
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Exhibit Number	Exhibit Description	Filed with this Report	Incorporated by Reference herein from Form or Schedule	Filing Date	SEC File/Reg. Number
10.31	At Market Issuance Sales Agreement, dated November 5, 2020, by and between the Company and B. Riley Securities, Inc.		Form 10-Q (Exhibit 10.1)	11/5/20	001-36481
14.1	Code of business conduct and ethics.		Form 10-K (Exhibit 14.1)	3/6/20	001-36481
21.1	Subsidiaries of the Registrant.	X			
23.1	Consent of KPMG LLP.	X			
31.1	Certification of principal executive officer under Section 302(a) of the Sarbanes-Oxley Act of 2002.	X			
31.2	Certification of principal financial officer under Section 302(a) of the Sarbanes-Oxley Act of 2002.	X			
32	Certifications of the principal executive officer and the principal financial officer under Section 906 of the Sarbanes-Oxley Act of 2002.	X			
101.INS	XBRL Instance Document - the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL document.	X			
101.SCH	Inline XBRL Taxonomy Extension Schema Document.	X			
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase Document.	X			
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase Document.	X			
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase Document.	X			
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase Document.	X			
104	Cover Page Interactive Data File (embedded within the Inline XBRL document).	X			

⁺ Management contract or compensatory plan or arrangement.

Item 16. FORM 10-K SUMMARY

None.

^{*} Confidential treatment has been granted with respect to certain portions of this Exhibit, which portions have been omitted and filed separately with the Securities and Exchange Commission as part of an application for confidential treatment pursuant to the Securities Act of 1933, as amended.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

ASPEN AEROGELS, INC.

Date: March 12, 2021 By: /s/ Donald R. Young

Donald R. Young

President and Chief Executive Officer

(principal executive officer)

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities indicated below and on the dates indicated.

Signature	Title	Date
/s/ Donald R. Young Donald R. Young	President, Chief Executive Officer and Director (principal executive officer)	March 12, 2021
/s/ John F. Fairbanks John F. Fairbanks	Vice President, Chief Financial Officer and Treasurer (principal financial officer and principal accounting officer)	March 12, 2021
/s/ William P. Noglows William P. Noglows	Chairman of the Board	March 12, 2021
/s/ Rebecca B. Blalock Rebecca B. Blalock	Director and Chair of the Nominating and Governance Committee	March 12, 2021
/s/ Robert M. Gervis Robert M. Gervis	Director and Chair of the Compensation and Leadership Development Committee	March 12, 2021
/s/ Steven R. Mitchell Steven R. Mitchell	Director	March 12, 2021
/s/ Mark L. Noetzel Mark L. Noetzel	Director	March 12, 2021
/s/ Richard F. Reilly Richard F. Reilly	Director and Chair of the Audit Committee	March 12, 2021

TWELFTH AMENDMENT TO AMENDED AND RESTATED LOAN AND SECURITY AGREEMENT

This Twelfth Amendment to Amended and Restated Loan and Security Agreement (this "Amendment") is entered into this December 24rd day of December, 2020 by and between SILICON VALLEY BANK ("Bank") and ASPEN AEROGELS, INC., a Delaware corporation ("Borrower") whose address is 30 Forbes Road, Building B, Northborough, Massachusetts 01532.

RECITALS

- A. Bank and Borrower have entered into that certain Amended and Restated Loan and Security Agreement dated as of September 3, 2014, as amended by that certain Consent and First Amendment to Amended and Restated Loan and Security Agreement dated as of August 19, 2016, as further amended by that certain Second Amendment to Amended and Restated Loan and Security Agreement dated as of November 23, 2016, as further amended by that certain Fourth Amendment to Amended and Restated Loan and Security Agreement dated as of December 29, 2016, as further amended by that certain Fourth Amendment to Amended and Restated Loan and Security Agreement dated as of January 27, 2017, as further amended by that certain Fifth Amendment to Amended and Restated Loan and Security Agreement dated as of September 27, 2017, as further amended by that certain Consent and Sixth Amendment to Amended and Restated Loan and Security Agreement dated as of January 25, 2018, as further amended by that certain Seventh Amendment to Amended and Restated Loan and Security Agreement dated as of April 25, 2018, as further amended by that certain Eighth Amendment to Amended and Restated Loan and Security Agreement and First Amendment to Preemptive Forbearance and Conditional Waiver Agreement dated as of November 30, 2018, as further amended by that certain Ninth Amendment to Amended and Restated Loan and Security Agreement dated as of March 4, 2019, as further amended by that certain Tenth Amendment to Amended and Restated Loan and Security Agreement dated as of September 25, 2020 (as amended, and as the same may from time to time be further amended, restated, amended and restated, modified and/or supplemented, the "Loan Agreement").
 - **B.** Bank has extended credit to Borrower for the purposes permitted in the Loan Agreement.
 - C. Borrower has requested that Bank amend the Loan Agreement to make certain revisions to the Loan Agreement as more fully set forth herein.
- **D.** Bank has agreed to so amend certain provisions of the Loan Agreement, but only to the extent, in accordance with the terms, subject to the conditions and in reliance upon the representations and warranties set forth below.

AGREEMENT

Now, THEREFORE, in consideration of the foregoing recitals and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, and intending to be legally bound, the parties hereto agree as follows:

- 1. **Definitions.** Capitalized terms used but not defined in this Amendment shall have the meanings given to them in the Loan Agreement.
- 2. Amendments to Loan Agreement.
 - 2.1 Section 2.4 (Payment of Interest on the Credit Extensions). Subsection (b) Section 3.6 is amended in its entirety and replaced

with the following:

- "(b) <u>Inability to Determine Applicable Interest Rate.</u>
- (i) In the event that Bank shall have determined (which determination shall be final and conclusive and binding upon all parties hereto), on any Interest Rate Determination Date with respect to any LIBOR Advance, that by reason of circumstances affecting the London interbank market adequate and fair means do not exist for ascertaining the interest rate applicable to such LIBOR Advance on the basis provided for in the definition of LIBOR, Bank shall on such date give notice to Borrower of such determination, whereupon (A) no Advances may be made as, or converted to, LIBOR Advances until such time as Bank notifies Borrower that the circumstances giving rise to such notice no longer exist, and (B) any Notice of Borrowing or Notice of Conversion/Continuation given by Borrower with respect to LIBOR Advances in respect of which such determination was made shall be deemed to be Prime Rate Advances unless such Notice of Borrowing or Notice of Conversion/Continuation shall be rescinded by Borrower in writing within [one] Business Day of Bank's giving of notice of its inability to determine the applicable interest rate for LIBOR Advances pursuant to this Section 3.6(b)(i).
- If at any time Bank determines (which determination shall be conclusive absent manifest error) that (A) the circumstances set forth in Section 3.6(b)(i) have arisen and such circumstances are unlikely to be temporary; or (B) the circumstances set forth in Section 3.6(b) (i) have not arisen but the supervisor for the administrator of the LIBOR reporting system or a Governmental Authority having jurisdiction over Bank has made a public statement announcing that such administrator has ceased or will cease to provide LIBOR, permanently or indefinitely, or that LIBOR is no longer representative, then Bank shall determine an alternate rate of interest to LIBOR and a spread adjustment mechanism that gives due consideration to (1) any selection or recommendation of a replacement rate or the mechanism for determining such a rate or spread adjustment mechanism by the Federal Reserve Board of Governors and/or a committee officially endorsed or convened by the Federal Reserve Board of Governors, or any successor thereto and/or (2) any evolving or then-prevailing market convention for determining a rate of interest as a replacement to LIBOR for similarly situated loans in the United States at such time, and Bank shall amend this Agreement to reflect such alternate rate of interest, such spread adjustment, and such other related changes to this Agreement as may be applicable; provided that if such alternate rate of interest shall be less than zero, such rate shall be deemed to be zero for the purposes of this Agreement. Bank shall provide Borrower with notice of such amendment. Notwithstanding anything to the contrary in Section 12.7 Amendments in Writing; Waiver; Integration, such amendment shall become effective at 5:00 p.m. Pacific time on the tenth (10th) Business Day after Bank has provided such amendment to Borrower without any further action or consent of Borrower, so long as Bank has not received, by such time, written notice of objection to such amendment from Borrower. In the event that Borrower objects to such amendment, Bank and Borrower shall endeavor to agree on an alternate rate of interest that is mutually acceptable. Until an alternate rate of interest shall be determined in accordance with this Section 3.6(b)(ii) (but in the case of the circumstances described in clause (2) of the first sentence of this Section 3.6(b)(ii), only to the extent that LIBOR for such Interest Period is not available or published at such time on a current basis), (x) any LIBOR Advances requested to be made shall be

made as Prime Rate Advances, and (y) any outstanding LIBOR Advances shall be converted, on the last day of the then-current Interest Period, to Prime Rate Advances."

Section 6.9 (Financial Covenants). Section 6.9 is amended by inserting the following provision at the end thereof:

"For the quarterly periods ending after December 31, 2020, the minimum EBITDA financial covenant thresholds shall be determined by Bank in its sole discretion on or before February 28, 2021 based on the Board-approved projections delivered to Bank pursuant to Section 6.2(f) hereof; provided further, that failure to timely deliver such Board-approved projections in accordance with Section 6.2(f) shall result in an immediate Event of Default for which no cure or grace period shall apply."

2.3 Exhibit B (Compliance Certificate). The Compliance Certificate attached to the Loan Agreement as **Exhibit B** is amended in its entirety and replaced with the Compliance Certificate in the form of **Exhibit B** attached hereto.

3. Limitation of Amendments.

- 3.1 The amendments set forth in Section 2 above are effective for the purposes set forth herein and shall be limited precisely as written and shall not be deemed to (a) be a consent to any amendment, waiver or modification of any other term or condition of any Loan Document, or (b) otherwise prejudice any right or remedy which Bank may now have or may have in the future under or in connection with any Loan Document.
- 3.2 This Amendment shall be construed in connection with and as part of the Loan Documents and all terms, conditions, representations, warranties, covenants and agreements set forth in the Loan Documents, except as herein amended, are hereby ratified and confirmed and shall remain in full force and effect.
 - 4. Acknowledgement of Potential Default; Preemptive Waiver. Borrower has advised Bank that Borrower anticipates that it may be in default of the minimum EBITDA financial covenant set forth in former Section 6.9 for the compliance period ending December 31, 2020 (the "Anticipated Default"). Bank hereby preemptively waives the Anticipated Default, but only for the specific compliance period referenced above. Borrower hereby acknowledges and agrees that except as specifically provided herein, nothing in this section or anywhere in this Amendment shall be deemed or otherwise construed as a waiver by Bank of any of its rights and remedies pursuant to the Loan Documents, applicable law or otherwise.
 - 5. Representations and Warranties. To induce Bank to enter into this Amendment, Borrower hereby represents and warrants to Bank as follows:
- 5.1 Immediately after giving effect to this Amendment (a) the representations and warranties contained in the Loan Documents are true, accurate and complete in all material respects as of the date hereof (except to the extent such representations and warranties relate to an earlier date, in which case they are true and correct as of such date), and (b) no Event of Default has occurred and is continuing;
- **5.2** Borrower has the power and authority to execute and deliver this Amendment and to perform its obligations under the Loan Agreement, as amended by this Amendment;
- 5.3 The organizational documents of Borrower delivered to Bank on the Effective Date remain true, accurate and complete and have not been amended, supplemented or restated and are and continue to be in full force and effect;
- 5.4 The execution and delivery by Borrower of this Amendment and the performance by Borrower of its obligations under the Loan Agreement, as amended by this Amendment, have been duly authorized;

- 5.5 The execution and delivery by Borrower of this Amendment and the performance by Borrower of its obligations under the Loan Agreement, as amended by this Amendment, do not and will not contravene (a) any law or regulation binding on or affecting Borrower, (b) any contractual restriction with a Person binding on Borrower, (c) any order, judgment or decree of any court or other governmental or public body or authority, or subdivision thereof, binding on Borrower, or (d) the organizational documents of Borrower;
- 5.6 The execution and delivery by Borrower of this Amendment and the performance by Borrower of its obligations under the Loan Agreement, as amended by this Amendment, do not require any order, consent, approval, license, authorization or validation of, or filing, recording or registration with, or exemption by any governmental or public body or authority, or subdivision thereof, binding on Borrower, except as already has been obtained or made; and
- 5.7 This Amendment has been duly executed and delivered by Borrower and is the binding obligation of Borrower, enforceable against Borrower in accordance with its terms, except as such enforceability may be limited by bankruptcy, insolvency, reorganization, liquidation, moratorium or other similar laws of general application and equitable principles relating to or affecting creditors' rights.
 - **Ratification of Perfection Certificate**. Borrower hereby ratifies, confirms and reaffirms, all and singular, the terms and disclosures contained in a certain Perfection Certificate dated as of March 2, 2020, and acknowledges, confirms and agrees that the disclosures and information Borrower provided to Bank in such Perfection Certificate have not changed, as of the date hereof.
 - 7. **No Defenses of Borrower.** Borrower hereby acknowledges and agrees that Borrower has no offsets, defenses, claims, or counterclaims against Bank with respect to the Obligations, or otherwise, and that if Borrower now has, or ever did have, any offsets, defenses, claims, or counterclaims against Bank, whether known or unknown, at law or in equity, all of them are hereby expressly WAIVED and Borrower hereby RELEASES Bank from any liability thereunder.
 - **8. Integration.** This Amendment and the Loan Documents represent the entire agreement about this subject matter and supersede prior negotiations or agreements. All prior agreements, understandings, representations, warranties, and negotiations between the parties about the subject matter of this Amendment and the Loan Documents merge into this Amendment and the Loan Documents.
 - **9. Counterparts.** This Amendment may be executed in any number of counterparts and all of such counterparts taken together shall be deemed to constitute one and the same instrument.
 - 10. Fees and Expenses. Borrower agrees to promptly pay Bank, upon receipt of an invoice, Bank's legal fees and expenses incurred in connection with this Amendment.
 - 11. Effectiveness. As a condition precedent to the effectiveness of this Amendment and the Bank's obligation to make further Advances under the Revolving Line, the Bank shall have received the following documents prior to or concurrently with this Amendment, each in form and substance reasonably satisfactory to Bank:
 - 11.1 this Amendment duly executed on behalf of Borrower;
- 11.2 the Acknowledgment of Amendment and Reaffirmation of Guaranty substantially in the form attached hereto as <u>Schedule 1</u>, duly executed and delivered by Guarantor;
- 11.3 Borrower's payment of a fully earned, non-refundable amendment fee in the amount of Twelve Thousand Five Hundred Dollars (\$12,500), payable in full on the date hereof; and
 - 11.4 such other documents as Bank may reasonably request.

[Signature page follows.]

In Witness Whereof, the parties hereto have caused this Amendment to be duly executed and delivered as of the date first written above.

BANK	BANK		BORROWER			
SILICON	I VALLEY BANK	ASPEN A	AEROGELS, INC.			
Ву:	/s/Steve Lyons	By:	/s/John F. Fairbanks			
Name:	Steve Lyons	Name:	John Fairbanks			
Title:	Director	Title:	Chief Financial Officer			

Schedule 1

ACKNOWLEDGMENT OF AMENDMENT AND REAFFIRMATION OF GUARANTY

Section 1.	Guarantor hereby acknowledges and confirms that it has reviewed and approved the terms and conditions of the	he Twelfth Amendment to
Amended and Restated Loan an	d Security Agreement dated as of the date hereof ("the "Amendment").	

- Section 2. Guarantor hereby consents to the Amendment and agrees that the Guaranty relating to the Obligations of Borrower under the Loan Agreement shall continue in full force and effect, shall be valid and enforceable and shall not be impaired or otherwise affected by the execution of the Amendment or any other document or instruction delivered in connection herewith.
- **Section 3.** Guarantor represents and warrants that, after giving effect to the Amendment, all representations and warranties contained in the Guaranty are true, accurate and complete as if made the date hereof.

Dated as of December 24, 2020.

[Signature Page Follows]

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ASPEN AEROGELS RHODE ISLAND, LLC

By: /s/John F. Fairbanks

Name: John Fairbanks
Title: Chief Financial Officer

EXHIBIT B

COMPLIANCE CERTIFICATE

Date:

The undersigned authorized officer of Aspen Aerogels, Inc. ("Borrower") certifies that under the terms and conditions of the Amended and
Restated Loan and Security Agreement between Borrower and Bank (as amended and in effect, the "Agreement"), (1) Borrower is in complete compliance for the
period ending with all required covenants except as noted below, (2) there are no Events of Default, (3) all representations and warranties in the
Agreement are true and correct in all material respects on this date except as noted below; provided, however, that such materiality qualifier shall not be applicable to
any representations and warranties that already are qualified or modified by materiality in the text thereof; and provided, further that those representations and
warranties expressly referring to a specific date shall be true, accurate and complete in all material respects as of such date, (4) Borrower, and each of its Subsidiaries,
has timely filed all required tax returns and reports, and Borrower has timely paid all foreign, federal, state and local taxes, assessments, deposits and contributions owed
by Borrower except as otherwise permitted pursuant to the terms of Section 5.9 of the Agreement, and (5) no Liens have been levied or claims made against Borrower or
any of its Subsidiaries, if any, relating to unpaid employee payroll or benefits of which Borrower has not previously provided written notification to Bank. Attached are
the required documents supporting the certification. The undersigned certifies that these are prepared in accordance with GAAP consistently applied from one period to
the next except as explained in an accompanying letter or footnotes. The undersigned acknowledges that no borrowings may be requested at any time or date of
determination that Borrower is not in compliance with any of the terms of the Agreement, and that compliance is determined not just at the date this certificate is
delivered. Capitalized terms used but not otherwise defined herein shall have the meanings given them in the Agreement.

Please indicate compliance status by circling Yes/No under "Complies" column.

SILICON VALLEY BANK

ASPEN AEROGELS, INC.

Reporting Covenant Required		Complies
Monthly financial statements with	Monthly within 30 days	Yes No
Compliance Certificate		
Quarterly financial statements	Quarterly within 45 days	Yes No
Annual financial statement (CPA Audited) + CC	FYE within 150 days	Yes No
10-Q, 10-K and 8-K	Within 5 days after filing with SEC	Yes No
A/R & A/P Agings, and Deferred Revenue reports	Monthly within 20 days	Yes No
Borrowing Base Reports	15th and last Business Day of each month (monthly	Yes No
	within 20 days when a Streamline Period is in effect)	
	and with each request for a Credit Extension;	
Projections	FYE within 30 days	Yes No

<u>Financial Covenant</u>	Required	Actual	<u>Complies</u>
Maintain as indicated:			
Minimum EBITDA	*	\$	Yes No

^{*}See Section 6.9

TO:

FROM:

	Performance Pricing	<u>Applies</u>
Adjusted Quick Ratio at least 1.50:1.00	Prime + 0.75% (Eligible Accounts) or Prime + 1.25% (Eligible Foreign Accounts); LIBOR + 3.75% (Eligible Accounts) or LIBOR +4.25% (Eligible Foreign Accounts)	Yes No
Adjusted Quick Ratio less than 1.50:1.00	Prime + 1.50% (Eligible Accounts); Prime + 2.00% (Eligible Foreign Accounts)	Yes No

	11000 111110)		
The following financial covenant analyses and information	on set forth in Schedule 1 attached hereto are true and acc	curate as of the date of this Certificate.	
The following are the exceptions with respect to the certif	fication above: (If no exceptions exist, state "No exception	ons to note.")	
ASPEN AEROGELS, INC.	BANK USE ONLY		
Ву:	Received by:		
Name:		AUTHORIZED SIGNER	
Title:	Date:		
	Verified:		
		AUTHORIZED SIGNER	
	Date:		
	Compliance Status:	Yes No	

Schedule 1 to Compliance Certificate

Financial Covenants of Borrower

In the event of a conflict between this Schedule and the Loan Agreement, the terms of the Loan Agreement shall govern.

I. EBITDA (Section 6.9)

Required:

Borrower shall achieve, measured as of the end of each fiscal quarter during the following periods, EBITDA of at least (loss not worse than) the following for the following periods:

Period	Minimum EBITDA (maximum loss)	
Trailing three (3) month period ending March 31, 2020	(\$4,500,000)	
Trailing six (6) month period ending June 30, 2020	(\$6,500,000)	
Trailing nine (9) month period ending September 30, 2020	(\$5,000,000)	
Trailing twelve (12) month period ending December 31, 2020	(\$7,000,000)	

For the quarterly periods ending after December 31, 2020, the minimum EBITDA financial covenant thresholds shall be determined by Bank in its sole discretion on or before February 28, 2021 based on the Board-approved projections delivered to Bank pursuant to Section 6.2(f) hereof; provided further, that failure to timely deliver such Board-approved projections in accordance with Section 6.2(f) shall result in an immediate Event of Default for which no cure or grace period shall apply.

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Actual:

A.	Net Income		\$
B.	To the extent included in the determination of Net Income		
	1.	The provision for income taxes	\$
	2.	Depreciation expense	\$
	3.	Amortization expense	\$
	4. Net Interest Expense		\$
	5.	Non-cash stock compensation expense	\$
	6.	The sum of lines 1 through 5	\$
C.	EBITDA (line A plus line B.6)		
Is line C	equal to or grea	ater than \$?	
No, not in compliance Yes, in compliance			

SECOND AMENDED AND RESTATED LOAN AND SECURITY AGREEMENT

THIS SECOND AMENDED AND RESTATED LOAN AND SECURITY AGREEMENT (this "Agreement") dated as of March 12, 2021 (the "Effective Date") between SILICON VALLEY BANK, a California corporation ("Bank"), and ASPEN AEROGELS, INC., a Delaware corporation ("Borrower"), provides the terms on which Bank shall lend to Borrower and Borrower shall repay Bank. This Agreement amends and restates in its entirety that certain Amended and Restated Loan and Security Agreement dated as of September 3, 2014, as amended by that certain Consent and First Amendment to Amended and Restated Loan and Security Agreement dated as of August 19, 2016, as further amended by that certain Second Amendment to Amended and Restated Loan and Security Agreement dated as of November 23, 2016, as further amended by that certain Third Amendment to Amended and Restated Loan and Security Agreement dated as of December 29, 2016, as further amended by that certain Fourth Amendment to Amended and Restated Loan and Security Agreement dated as of January 27, 2017, as further amended by that certain Fifth Amendment to Amended and Restated Loan and Security Agreement dated as of September 27, 2017, as further amended by that certain Consent and Sixth Amendment to Amended and Restated Loan and Security Agreement dated as of January 25, 2018, as further amended by that certain Seventh Amendment to Amended and Restated Loan and Security Agreement dated as of April 25, 2018, as further amended by that certain Eighth Amendment to Amended and Restated Loan and Security Agreement and First Amendment to Preemptive Forbearance and Conditional Waiver Agreement dated as of November 30, 2018, as further amended by that certain Ninth Amendment to Amended and Restated Loan and Security Agreement dated as of March 4, 2019, as further amended by that certain Tenth Amendment to Amended and Restated Loan and Security Agreement dated as of March 3, 2020, as further amended by that certain Eleventh Amendment to Amended and Restated Loan and Security Agreement dated as of September 25, 2020, and as further amended by that certain Twelfth Amendment to Amended and Restated Loan and Security Agreement dated as of December 24, 2020 (as amended, and as the same may from time to time be further amended, restated, amended and restated, modified and/or supplemented, the "Prior Loan Agreement"). The parties agree as follows:

1 ACCOUNTING AND OTHER TERMS

Accounting terms not defined in this Agreement shall be construed following GAAP. Calculations and determinations must be made following GAAP. Capitalized terms not otherwise defined in this Agreement shall have the meanings set forth in Section 13. All other terms contained in this Agreement, unless otherwise indicated, shall have the meaning provided by the Code to the extent such terms are defined therein.

2 LOAN AND TERMS OF PAYMENT

2.1 Promise to Pay. Borrower hereby unconditionally promises to pay Bank the outstanding principal amount of all Credit Extensions and accrued and unpaid interest thereon as and when due in accordance with this Agreement.

2.2 Credit Extensions

2.2.1 Revolving Advances.

- (a) <u>Availability</u>. Subject to the terms and conditions of this Agreement and to deduction of Reserves, Bank shall make Advances not exceeding the Availability Amount. Amounts borrowed under the Revolving Line may be repaid and, prior to the Revolving Line Maturity Date, reborrowed, subject to the applicable terms and conditions precedent herein.
- (b) <u>Termination; Repayment</u>. The Revolving Line terminates on the Revolving Line Maturity Date, when the principal amount of all Advances, the unpaid interest thereon, and all other Obligations relating to the Revolving Line shall be immediately due and payable.

2.2.2 Letters of Credit Sublimit.

- (a) As part of the Revolving Line and subject to deduction of Reserves, Bank shall issue or have issued Letters of Credit denominated in Dollars or a Foreign Currency for Borrower's account. The aggregate undrawn Dollar Equivalent of the face amount of outstanding Letters of Credit (plus the drawn but unreimbursed Letters of Credit and any Letter of Credit Reserve) shall at all times reduce the amount otherwise available for Advances under the Revolving Line. The aggregate undrawn Dollar Equivalent of the face amount of outstanding Letters of Credit (plus the drawn but unreimbursed Letters of Credit and any Letter of Credit Reserve) may not exceed the lesser of (A) (i) Five Million Dollars (\$5,000,000), minus (ii) the sum of all amounts used for Cash Management Services, minus (iii) the FX Reduction Amount, or (B) (i) the lesser of (I) the Revolving Line or (II) the Borrowing Base, minus (ii) the sum of all outstanding principal amounts of any Advances (including any amounts used for Cash Management Services), minus (iii) the FX Reduction Amount.
- (b) If, on the Revolving Line Maturity Date (or the effective date of any termination of this Agreement), there are any outstanding Letters of Credit, then on such date Borrower shall provide to Bank cash collateral in an amount equal to the sum of (i) 105% of the Dollar Equivalent of the undrawn face amount of all such Letters of Credit plus (ii) 100% of all interest, fees, and costs due or to become due in connection therewith (as estimated by Bank in its good faith business judgment), to secure all of the Obligations relating to such Letters of Credit. All Letters of Credit shall be in form and substance acceptable to Bank in its sole discretion and shall be subject to the terms and conditions of Bank's standard Application and Letter of Credit Agreement (the "Letter of Credit Application"). Borrower agrees to execute any further documentation in connection with the Letters of Credit as Bank may reasonably request. Borrower further agrees to be bound by the regulations and interpretations of the issuer of any Letters of Credit guarantied by Bank and opened for Borrower's account or by Bank's interpretations of any Letter of Credit issued by Bank for Borrower's account, and Borrower understands and agrees that Bank shall not be liable for any error, negligence, or mistake, whether of omission or commission, in following Borrower's instructions or those contained in the Letters of Credit or any modifications, amendments, or supplements thereto.
- (c) The obligation of Borrower to immediately reimburse Bank for drawings made under Letters of Credit shall be absolute, unconditional, and irrevocable, and shall be performed strictly in accordance with the terms of this Agreement, such Letters of Credit, and the Letter of Credit Application.
- (d) Borrower may request that Bank issue a Letter of Credit payable in a Foreign Currency. If a demand for payment is made under any such Letter of Credit, Bank shall treat such demand as an Advance to Borrower of the Dollar Equivalent of the amount thereof (plus fees and charges in connection therewith such as wire, cable, SWIFT or similar charges).
- (e) To guard against fluctuations in currency exchange rates, upon the issuance of any Letter of Credit payable in a Foreign Currency, Bank shall create a reserve (the "Letter of Credit Reserve") under the Revolving Line in an amount equal to ten percent (10%) of the Dollar Equivalent of the undrawn face amount of such Letter of Credit. The amount of the Letter of Credit Reserve may be adjusted by Bank from time to time to account for fluctuations in the exchange rate. The availability of funds under the Revolving Line shall be reduced by the amount of such Letter of Credit Reserve for as long as such Letter of Credit remains outstanding.
- **2.2.3 Foreign Exchange Sublimit.** As part of the Revolving Line and subject to the deduction of Reserves, Borrower may enter into foreign exchange contracts with Bank under which Borrower commits to purchase from or sell to Bank a specific amount of Foreign Currency (each, a "FX Contract") on a specified date (the "Settlement Date"). FX Contracts shall have a Settlement Date of at least one (1) FX Business Day after the contract date. The aggregate amount of FX Contracts at any one time may not exceed ten (10) times the lesser of (A) (i) Five Million Dollars (\$5,000,000), minus (ii) the sum of all amounts used for Cash Management Services, minus (iii) the aggregate Dollar Equivalent of the undrawn face amount of any outstanding Letters of Credit (plus drawn but unreimbursed Letters of Credit and any Letter of Credit (plus any amounts used for Cash Management Services), minus (iii) the aggregate Dollar Equivalent of the face amount of any outstanding Letters of Credit (including drawn but unreimbursed Letters of Credit and any Letter of Credit Reserve). The amount otherwise available for Credit Extensions under the Revolving Line shall be reduced by an amount equal to ten percent (10%)

of each outstanding FX Contract (the "FX Reduction Amount"). Any amounts needed to fully reimburse Bank for any amounts not paid by Borrower in connection with FX Contracts will be treated as Advances under the Revolving Line and will accrue interest at the interest rate applicable to Advances.

- **2.2.4** Cash Management Services Sublimit. Borrower may use the Revolving Line for Bank's cash management services, which may include merchant services, direct deposit of payroll, business credit card, and check cashing services identified in Bank's various cash management services agreements (collectively, the "Cash Management Services"), in an aggregate amount not to exceed the lesser of (A) (i) Five Million Dollars (\$5,000,000), minus (ii) the aggregate Dollar Equivalent of the undrawn face amount of any outstanding Letters of Credit (plus drawn but unreimbursed Letters of Credit and any Letter of Credit Reserve), minus (iii) the FX Reduction Amount, or (B) (i) the lesser of (I) the Revolving Line or (II) the Borrowing Base, minus (ii) the sum of all outstanding principal amounts of any Advances, minus (iii) the aggregate Dollar Equivalent of the undrawn face amount of any outstanding Letters of Credit (plus drawn but unreimbursed Letters of Credit and any Letter of Credit Reserve), minus (iv) the FX Reduction Amount. Any amounts Bank pays on behalf of Borrower for any Cash Management Services will be treated as Advances under the Revolving Line and will accrue interest at the interest rate applicable to Advances.
- **2.3 Overadvances**. If, at any time, the sum of (a) the outstanding principal amount of any Advances (including any amounts used for Cash Management Services), plus (b) the undrawn face amount of any outstanding Letters of Credit (plus drawn but unreimbursed Letters of Credit and any Letter of Credit Reserve), plus (c) the FX Reduction Amount exceeds the lesser of either the Revolving Line or the Borrowing Base (such excess amount being an "**Overadvance**"), Borrower shall immediately pay to Bank in cash such Overadvance. Without limiting Borrower's obligation to repay Bank any amount of the Overadvance, Borrower agrees to pay Bank interest on the outstanding amount of any Overadvance, on demand, at a per annum rate equal to the rate that is otherwise applicable to Advances plus five percent (5.00%).

2.4 Payment of Interest on the Credit Extensions.

- (a) Interest; Payment. Each Advance shall bear interest on the outstanding principal amount thereof from the date when made, continued or converted until paid in full at a rate per annum equal to the greater of (i) four percent (4.00%) and (ii) the Prime Rate plus the applicable Prime Rate Margin. Pursuant to the terms hereof, interest on each Advance shall be paid in arrears on each Interest Payment Date. Interest shall also be paid on the date of any prepayment of any Advance pursuant to this Agreement for the portion of any Advance so prepaid and upon payment (including prepayment) in full thereof. All accrued but unpaid interest on the Advances shall be due and payable on the Revolving Line Maturity Date.
- (b) Adjustment to Interest Rate. Changes to the interest rate of any Credit Extension based on changes to the Prime Rate shall be effective on the effective date of any change to the Prime Rate and to the extent of any such change..
 - (c) [Reserved].
- (d) <u>Computation of Interest</u>. Any interest hereunder will accrue from day to day and is calculated on the basis of the actual number of days elapsed and a year of 360 days. In computing interest on any Credit Extension, the date of the making of such Credit Extension shall be included and the date of payment shall be excluded; provided, however, that if any Credit Extension is repaid on the same day on which it is made, such day shall be included in computing interest on such Credit Extension.
- (e) <u>Default Rate</u>. Except as otherwise provided in Section 2.4(a), upon the occurrence and during the continuance of an Event of Default, Obligations shall bear interest at a rate per annum which is five percentage points (5.0%) above the rate that would otherwise be applicable thereto (the "**Default Rate**") unless Bank otherwise elects from time to time in its sole discretion to impose a smaller increase. Payment or acceptance of the increased interest provided in this Section 2.4(e) is not a permitted alternative to timely payment and shall not constitute a waiver of any Event of Default or otherwise prejudice or limit any rights or remedies of Bank.
 - **2.5 Fees**. Borrower shall pay to Bank:

- (a) <u>Commitment Fee</u>. A fully earned, non-refundable commitment fee of Fifty Thousand Dollars (\$50,000), on the Effective Date, which, for the avoidance of doubt, is in addition to any commitment fee paid by Borrower prior to the Effective Date;
 - (b) [Intentionally deleted.]
- (c) <u>Unused Revolving Line Facility Fee.</u> Payable monthly in arrears on the last day of the month following the Effective Date, on the last day of each month occurring thereafter prior to the Revolving Line Maturity Date, and on the Revolving Line Maturity Date, a fee (the "Unused Revolving Line Facility Fee") in an amount equal to one-half of one percent (0.50%) per annum of the average unused portion of the Revolving Line, as determined by Bank. The unused portion of the Revolving Line, for purposes of this calculation, shall be calculated on a calendar year basis and shall equal the difference between (i) the Revolving Line, and (ii) the average for the period of the daily closing balance of the Revolving Line outstanding;
- (d) Letter of Credit Fee. Bank's customary fees and expenses for the issuance or renewal of Letters of Credit, including, without limitation, a letter of credit fee of two percent (2.00%) per annum of the Dollar Equivalent of the face amount of each Letter of Credit issued, upon the issuance of such Letter of Credit, each anniversary of the issuance during the term of such Letter of Credit, and upon the renewal of such Letter of Credit by Bank; and
- (e) <u>Bank Expenses.</u> All Bank Expenses (including reasonable attorneys' fees and expenses for documentation and negotiation of this Agreement) incurred through and after the Effective Date, when due (or, if no stated due date, upon demand by Bank).
- (f) Fees Fully Earned. Unless otherwise provided in this Agreement or in a separate writing by Bank, Borrower shall not be entitled to any credit, rebate, or repayment of any fees earned by Bank pursuant to this Agreement notwithstanding any termination of this Agreement or the suspension or termination of Bank's obligation to make loans and advances hereunder. Bank may deduct amounts owing by Borrower under the clauses of this Section 2.5 pursuant to the terms of Section 2.6(c). Bank shall provide Borrower written notice of deductions made from the Designated Deposit Account pursuant to the terms of the clauses of this Section 2.5.

2.6 Payments; Application of Payments; Debit of Accounts.

- (a) All payments (including prepayments) to be made by Borrower under any Loan Document shall be made in immediately available funds in Dollars, without setoff or counterclaim, before 12:00 p.m. Eastern time on the date when due. Payments of principal and/or interest received after 12:00 p.m. Eastern time are considered received at the opening of business on the next Business Day. When a payment is due on a day that is not a Business Day, the payment shall be due the next Business Day, and additional fees or interest, as applicable, shall continue to accrue until paid.
- (b) Subject to Section 6.3(c), Bank shall apply the whole or any part of collected funds against the Revolving Line, or credit such collected funds to a Deposit Account of Borrower at Bank or an Affiliate of Bank, the order and method of such application to be in the sole discretion of Bank. Borrower shall have no right to specify the order or the accounts to which Bank shall allocate or apply any payments required to be made by Borrower to Bank or otherwise received by Bank under this Agreement when any such allocation or application is not specified elsewhere in this Agreement.
- (c) Bank may debit any of Borrower's deposit accounts, including the Designated Deposit Account, but excluding any Excluded Deposit Account, for principal and interest payments or any other amounts Borrower owes Bank when due. These debits shall not constitute a set-off.
- 2.7 Withholding. Payments received by Bank from Borrower under this Agreement will be made free and clear of and without deduction for any and all present or future taxes, levies, imposts, duties, deductions, withholdings, assessments, fees or other charges imposed by any Governmental Authority (including any interest, additions to tax or penalties applicable thereto). Specifically, however, if at any time any Governmental Authority,

applicable law, regulation or international agreement requires Borrower to make any withholding or deduction from any such payment or other sum payable hereunder to Bank, Borrower hereby covenants and agrees that the amount due from Borrower with respect to such payment or other sum payable hereunder will be increased to the extent necessary to ensure that, after the making of such required withholding or deduction, Bank receives a net sum equal to the sum which it would have received had no withholding or deduction been required, and Borrower shall pay the full amount withheld or deducted to the relevant Governmental Authority. Borrower will, upon request, furnish Bank with proof reasonably satisfactory to Bank indicating that Borrower has made such withholding payment; provided, however, that Borrower need not make any withholding payment if the amount or validity of such withholding payment is contested in good faith by appropriate and timely proceedings and as to which payment in full is bonded or reserved against by Borrower. The agreements and obligations of Borrower contained in this Section 2.7 shall survive the termination of this Agreement.

3 CONDITIONS OF LOANS

- 3.1 Conditions Precedent to Initial Credit Extension. Bank's obligation to make the initial Credit Extension is subject to the condition precedent that Bank shall have received, in form and substance reasonably satisfactory to Bank, such documents, and completion of such other matters, as Bank may reasonably deem necessary or appropriate, including, without limitation:
 - (a) duly executed signatures to the Loan Documents;
 - (b) the Acknowledgement of Amendment and Reaffirmation of Guaranty and Security Agreement duly executed by Aspen Aerogels

Rhode Island;

effect: and

- (c) the Operating Documents and long-form good standing certificates of Borrower certified by the Secretary of State (or equivalent agency) of Borrower's and each Guarantors' jurisdiction of organization or formation, each as of a date no earlier than thirty (30) days prior to the Effective Date;
 - (d) certified copies of the Borrowing Resolutions for Borrower and Guarantor;
- (e) certified copies, dated as of a recent date, of financing statement searches, as Bank may request, accompanied by written evidence (including any UCC termination statements) that the Liens indicated in any such financing statements either constitute Permitted Liens or have been or, in connection with the initial Credit Extension, will be terminated or released;
 - (f) the duly executed Perfection Certificates of Borrower and Guarantor;
- (g) a legal opinion of Borrower's and Guarantor's counsel, in form and substance acceptable to Bank in its reasonable discretion, dated as of the Effective Date;
 - (h) the duly executed signatures to a Secretary's Certificate for Borrower and Guarantor;
 - (i) evidence satisfactory to Bank that the insurance policies and endorsements required by Section 6.7 hereof are in full force and
 - (j) payment of the fees and Bank Expenses then due as specified in Section 2.5 hereof.
- 3.2 Conditions Precedent to all Credit Extensions. Bank's obligation to make each Credit Extension, including the initial Credit Extension, is subject to the following conditions precedent:
 - (a) timely receipt of the Credit Extension request and any materials and documents required by Section 3.4;
- (b) the representations and warranties in this Agreement shall be true, accurate, and complete in all material respects on the date of the proposed Credit Extension and on the Funding Date of each Credit Extension;

provided, however, that such materiality qualifier shall not be applicable to any representations and warranties that already are qualified or modified by materiality in the text thereof; and provided, further that those representations and warranties expressly referring to a specific date shall be true, accurate and complete in all material respects as of such date, and no Event of Default shall have occurred and be continuing or immediately result from the Credit Extension. Each Credit Extension is Borrower's representation and warranty on that date that the representations and warranties in this Agreement remain true, accurate, and complete in all material respects; provided, however, that such materiality qualifier shall not be applicable to any representations and warranties that already are qualified or modified by materiality in the text thereof; and provided, further that those representations and warranties expressly referring to a specific date shall be true, accurate and complete in all material respects as of such date; and

- (c) in Bank's sole discretion, there has not been a Material Adverse Change since December 31, 2013.
- 3.3 Covenant to Deliver. (a) Except as otherwise provided in Section 3.3(b). Borrower agrees to deliver to Bank each item required to be delivered to Bank under this Agreement as a condition precedent to any Credit Extension. Borrower expressly agrees that a Credit Extension made prior to the receipt by Bank of any such item shall not constitute a waiver by Bank of Borrower's obligation to deliver such item, and the making of any Credit Extension in the absence of a required item shall be in Bank's sole discretion.
 - (b) Unless otherwise provided in writing, within ten (10) days after the Effective Date, Borrower shall deliver to Bank a good standing certificate certified by the Secretary of the Commonwealth of Massachusetts dated as of a date no earlier than thirty (30) days prior to the date of delivery.
- 3.4 Procedures for Borrowing. Subject to the prior satisfaction of all other applicable conditions to the making of an Advance (other than Advances under Sections 2.3 or 2.5) set forth in this Agreement, to obtain an Advance, Borrower (via an individual duly authorized by an Administrator) shall notify Bank (which notice shall be irrevocable) by electronic mail by 12:00 p.m. Eastern time on the Funding Date of the Advance. Such notice shall be made by Borrower through Bank's online banking program, provided, however, if Borrower is not utilizing Bank's online banking program, then such notice shall be in a written format acceptable to Bank that is executed by an Authorized Signer. Bank shall have received satisfactory evidence that the Board has approved that such Authorized Signer may provide such notices and request Advances. In connection with any such notification, Borrower must promptly deliver to Bank by electronic mail or through Bank's online banking program such reports and information, including without limitation, sales journals, cash receipts journals, accounts receivable aging reports, as Bank may request in its sole discretion. Bank shall credit proceeds of an Advance to the Designated Deposit Account. Bank may make Advances under this Agreement based on instructions from an Authorized Signer or without instructions if the Advances are necessary to meet Obligations which have become due.

4 CREATION OF SECURITY INTEREST

4.1 Grant of Security Interest. Borrower hereby grants Bank, to secure the payment and performance in full of all of the Obligations, a continuing security interest in, and pledges to Bank, the Collateral, wherever located, whether now owned or hereafter acquired or arising, and all proceeds and products thereof

Borrower acknowledges that it previously has entered, and/or may in the future enter, into Bank Services Agreements with Bank. Regardless of the terms of any Bank Services Agreement, Borrower agrees that any amounts Borrower owes Bank thereunder shall be deemed to be Obligations hereunder and that it is the intent of Borrower and Bank to have all such Obligations secured by the first priority perfected security interest in the Collateral granted herein (subject only to Permitted Liens that are permitted pursuant to the terms of this Agreement to have superior priority to Bank's Lien in this Agreement).

If this Agreement is terminated, Bank's Lien in the Collateral shall continue until the Obligations (other than inchoate indemnity obligations and obligations with respect to Bank Services Agreements) are satisfied in full in cash. Upon satisfaction in full in cash of the Obligations (other than inchoate indemnity obligations and obligations with respect to Bank Services Agreements) and at such time as Bank's obligation to make Credit Extensions has terminated, Bank shall, at the sole cost and expense of Borrower, release its Liens in the Collateral and all rights

therein shall revert to Borrower. In the event (x) all Obligations (other than inchoate indemnity obligations), except for Bank Services, are satisfied in full, and (y) this Agreement is terminated, Bank shall terminate the security interest granted herein upon Borrower providing cash collateral acceptable to Bank in its good faith business judgment for Bank Services, if any. In the event such Bank Services consist of outstanding Letters of Credit, Borrower shall provide to Bank cash collateral in an amount equal to (x) if such Letters of Credit are denominated in Dollars, then at least one hundred five percent (105.0%); and (y) if such Letters of Credit are denominated in a Foreign Currency, then at least one hundred ten percent (110.0%), of the Dollar Equivalent of the undrawn face amount of all such Letters of Credit plus one hundred percent (100%) of all interest, fees, and costs due or to become due in connection therewith (as estimated by Bank in its good faith business judgment), to secure all of the Obligations relating to such Letters of Credit.

- 4.2 Priority of Security Interest. Borrower represents, warrants, and covenants that the security interest granted herein is and shall at all times continue to be a first priority perfected security interest in the Collateral (subject only to Permitted Liens that may have superior priority to Bank's Lien under this Agreement and to certain exceptions explicitly set forth in this Agreement). If Borrower shall acquire a commercial tort claim, Borrower shall promptly notify Bank in a writing signed by Borrower of the general details thereof and grant to Bank in such writing a security interest therein and in the proceeds thereof, all upon the terms of this Agreement, with such writing to be in form and substance reasonably satisfactory to Bank.
- **4.3 Authorization to File Financing Statements.** Borrower hereby authorizes Bank to file financing statements, with notice to Borrower, with all appropriate jurisdictions to perfect or protect Bank's interest or rights hereunder, including a notice that any disposition of the Collateral, by either Borrower or any other Person not in accordance with this Agreement, may be deemed to violate the rights of Bank under the Code.

5 REPRESENTATIONS AND WARRANTIES

Borrower represents and warrants as follows:

Due Organization; Authorization; Power and Authority. Borrower and each of its Subsidiaries are duly existing and in good standing as a Registered Organization in its jurisdiction of formation and each is qualified and licensed to do business and each is in good standing in any jurisdiction in which the conduct of each of its business or its ownership of property requires that it be qualified except where the failure to do so could not reasonably be expected to cause a Material Adverse Change. In connection with this Agreement, Borrower has delivered to Bank completed certificates each signed by Borrower and Guarantor, respectively, entitled "Perfection Certificate". Borrower represents and warrants to Bank that (a) Borrower's exact legal name is that indicated on the Perfection Certificate and on the signature page hereof; (b) Borrower is an organization of the type and is organized in the jurisdiction set forth in the Perfection Certificate; (c) the Perfection Certificate accurately sets forth Borrower's organizational identification number or accurately states that Borrower has none; (d) the Perfection Certificate accurately sets forth Borrower's place of business, or, if more than one, its chief executive office as well as Borrower's mailing address (if different than its chief executive office); (e) except as set forth on the Perfection Certificate, Borrower (and each of its predecessors) has not, in the past five (5) years, changed its jurisdiction of formation, organizational structure or type, or any organizational number assigned by its jurisdiction; and (f) all other information set forth on the Perfection Certificate pertaining to Borrower and each of its Subsidiaries is accurate and complete (it being understood and agreed that Borrower may from time to time update certain information in the Perfection Certificate after the Effective Date to the extent permitted by one or more specific provisions in this Agreement). If Borrower is not now a Registered Organization but later becomes one, Borrower sha

The execution, delivery and performance by Borrower of the Loan Documents to which it is a party have been duly authorized, and do not (i) conflict with any of Borrower's organizational documents, (ii) contravene, conflict with, constitute a default under or violate any material Requirement of Law, (iii) contravene, conflict or violate any applicable order, writ, judgment, injunction, decree, determination or award of any Governmental Authority by which Borrower or any of its Subsidiaries or any of their property or assets may be bound or affected, (iv) require any action by, filing, registration, or qualification with, or Governmental Approval from, any Governmental

Authority (except such Governmental Approvals which have already been obtained and are in full force and effect) or (v) constitute an event of default under any material agreement by which Borrower is bound. Borrower is not in default under any agreement to which it is a party or by which it is bound in which the default could reasonably be expected to have a Material Adverse Change.

5.2 Collateral. Borrower has good title to, has rights in, and the power to transfer each item of the Collateral upon which it purports to grant a Lien hereunder, free and clear of any and all Liens except Permitted Liens. Borrower has no Collateral Accounts at or with any bank or financial institution other than Bank or Bank's Affiliates except for the Collateral Accounts described in the Perfection Certificate delivered to Bank in connection herewith, or of which Borrower has given Bank notice and taken such actions as are necessary to give Bank a perfected security interest therein, to the extent required by Section 6.8(b). The Accounts are bona fide, existing obligations of the Account Debtors.

The Collateral is not in the possession of any third party bailee (such as a warehouse) except as otherwise provided in the Perfection Certificate. None of the components of the Collateral shall be maintained at locations other than as provided in the Perfection Certificate or as permitted pursuant to Section 7.2.

All Inventory is in all material respects of good and marketable quality, free from material defects, except normal and customary quality issues occurring in the ordinary course of business, in amounts consistent with past practices.

Borrower is the sole owner of the Intellectual Property which it owns or purports to solely own except for (a) non-exclusive licenses granted to its customers in the ordinary course of business, (b) over-the-counter software that is commercially available to the public, (c) any rights the U.S. Government may have in connection with Borrower's contracts with the U.S. Government entities as noted in the Perfection Certificate; and (d) material Intellectual Property licensed to Borrower and noted on the Perfection Certificate. Each Patent which it owns or purports to own and which is material to Borrower's business is valid and enforceable, and no part of the Intellectual Property which Borrower owns or purports to own and which is material to Borrower's business has been judged invalid or unenforceable, in whole or in part. To the best of Borrower's knowledge, no claim has been made that any part of the Intellectual Property violates the rights of any third party except to the extent such claim would not have a material adverse effect on Borrower's business, taken as a whole.

Except as noted on the Perfection Certificate, Borrower is not a party to, nor is it bound by, any Restricted License.

5.3 Accounts Receivable; Inventory.

- (a) For each Account with respect to which Advances are requested, on the date each Advance is requested and made, such Account shall be an Eligible Account.
- All statements made and all unpaid balances appearing in all invoices, instruments and other documents evidencing the Eligible Accounts are and shall be true and correct and all such invoices, instruments and other documents, and all of Borrower's Books are genuine and in all respects what they purport to be. Whether or not an Event of Default has occurred and is continuing, Bank may, after consultation with Borrower, notify any Account Debtor owing Borrower money of Bank's security interest in such funds and verify the amount of such Eligible Accounts. All sales and other transactions underlying or giving rise to each Eligible Account shall comply in all material respects with all applicable laws and governmental rules and regulations. Borrower has no knowledge of any actual or imminent Insolvency Proceeding of any Account Debtor whose accounts are Eligible Accounts in any Borrowing Base Report. To the Borrower's knowledge, all signatures and endorsements on all documents, instruments, and agreements relating to (i) all Eligible Accounts are genuine, and (ii) all such documents, instruments and agreements are legally enforceable in accordance with their terms.
- **5.4 Litigation**. There are no actions or proceedings pending or, to the knowledge of any Responsible Officer, threatened in writing by or against Borrower or any of its Subsidiaries involving more than, individually or in the aggregate, One Hundred Fifty Thousand Dollars (\$150,000).

- 5.5 Financial Condition. All consolidated financial statements for Borrower delivered to Bank fairly present in all material respects Borrower's consolidated financial condition and Borrower's consolidated results of operations. There has not been any Material Adverse Change since December 31, 2013.
- **5.6 Solvency**. The fair salable value of Borrower's and its Subsidiaries' assets, taken as a whole (including goodwill minus disposition costs) exceeds the fair value of their liabilities; Borrower and its Subsidiaries are not left with unreasonably small capital after the transactions in this Agreement; and Borrower and its Subsidiaries, taken as a whole, are able to pay their debts (including trade debts) as they mature.
- **5.7 Regulatory Compliance**. Borrower is not an "investment company" or a company "controlled" by an "investment company" under the Investment Company Act of 1940, as amended. Borrower is not engaged as one of its important activities in extending credit for margin stock (under Regulations X, T and U of the Federal Reserve Board of Governors). Borrower (a) has complied in all material respects with all Requirements of Law which would reasonably be expected to cause a Material Adverse Change, and (b) has not violated any Requirements of Law the violation of which could reasonably be expected to cause a Material Adverse Change. Except as described in the Perfection Certificate or otherwise disclosed to Bank, none of Borrower's or any of its Subsidiaries' properties or assets has been used by Borrower or any Subsidiary or, to the best of Borrower's knowledge, by previous Persons, in disposing, producing, storing, treating, or transporting any hazardous substance other than legally. Borrower and each of its Subsidiaries have obtained all consents, approvals and authorizations of, made all declarations or filings with, and given all notices to, all Government Authorities that are necessary to continue their respective businesses as currently conducted, the absence of which could reasonably be expected to have a material adverse effect on Borrower's business.
- 5.8 Subsidiaries; Investments. Borrower does not own any stock, partnership interest or other equity securities except for Permitted Investments.
- 5.9 Tax Returns and Payments; Pension Contributions. Borrower has timely filed all required tax returns and reports, and Borrower has timely paid all foreign, federal, state and material local taxes, assessments, deposits and contributions owed by Borrower except to the extent such taxes are being contested in good faith by appropriate proceedings promptly instituted and diligently conducted, so long as such reserve or other appropriate provision, if any, as shall be required in conformity with GAAP shall have been made therefor.

To the extent Borrower defers payment of any contested taxes in an amount in excess of \$100,000, Borrower shall (i) notify Bank in writing of the commencement of, and any material development in, the proceedings, and (ii) posts bonds or takes any other steps required to prevent the Governmental Authority levying such contested taxes from obtaining a Lien upon any of the Collateral that is other than a "Permitted Lien." Borrower is unaware of any claims or adjustments proposed for any of Borrower's prior tax years which could result in additional taxes in an amount in excess of \$100,000 becoming due and payable by Borrower. Borrower has paid all amounts necessary to fund all present pension, profit sharing and deferred compensation plans in accordance with their terms, and Borrower has not withdrawn from participation in, and has not permitted partial or complete termination of, or permitted the occurrence of any other event with respect to, any such plan which could reasonably be expected to result in any liability of Borrower in an amount in excess of \$100,000, including any liability to the Pension Benefit Guaranty Corporation or its successors or any other governmental agency.

- **5.10 Use of Proceeds**. Borrower shall use the proceeds of the Credit Extensions solely as working capital to fund its general business requirements and not for personal, family, household or agricultural purposes.
- **5.11 Full Disclosure**. No written representation, warranty or other statement of Borrower in any certificate or written statement given to Bank, as of the date such representation, warranty, or other statement was made, taken together with all such written certificates and written statements given to Bank, contains any untrue statement of a material fact or omits to state a material fact necessary to make the statements contained in the certificates or statements not misleading (it being recognized by Bank that the projections and forecasts provided by Borrower in good faith and based upon reasonable assumptions are not viewed as facts and that actual results during the period or periods covered by such projections and forecasts may differ from the projected or forecasted results).

5.12 Definition of "Knowledge." For purposes of the Loan Documents, whenever a representation or warranty is made to Borrower's knowledge or awareness, to the "best of' Borrower's knowledge, or with a similar qualification, knowledge or awareness means the actual knowledge, after reasonable investigation, of any Responsible Officer.

6 AFFIRMATIVE COVENANTS

Borrower shall do all of the following:

6.1 Government Compliance.

- (a) Maintain its and all its Subsidiaries' legal existence and good standing in their respective jurisdictions of formation and maintain qualification in each jurisdiction in which the failure to so qualify would reasonably be expected to have a material adverse effect on Borrower's business or operations. Borrower shall comply, and have each Subsidiary comply, in all material respects, with all laws, ordinances and regulations to which it is subject, the noncompliance with which could have a material adverse effect on Borrower's business.
- (b) Obtain all of the Governmental Approvals necessary for the performance by Borrower of its obligations under the Loan Documents to which it is a party and the grant of a security interest to Bank in the Collateral. Borrower shall, upon request from the Bank, promptly provide copies of any such obtained Governmental Approvals to Bank.

6.2 Financial Statements, Reports, Certificates. Provide Bank with the following:

- a Borrowing Base Report (and any schedules related thereto), including a detailed accounts receivable ledger, and, when a Streamline Period is not in effect, sales and collections reports (i) with each request for an Advance, (ii) on the fifteenth (15th) day (if the 15th is not a Business Day, on the preceding Business Day) and last day of each month when a Streamline Period is not in effect, and (iii) within twenty (20) days after the end of each month when a Streamline Period is in effect;
- (b) within twenty (20) days after the end of each month, (A) monthly accounts receivable agings, aged by invoice date, (B) monthly accounts payable agings, aged by invoice date, and outstanding or held check registers, if any, and (C) monthly reconciliations of accounts receivable agings (aged by invoice date), transaction reports, Deferred Revenue report, and general ledger;
- (c) as soon as available, but no later than thirty (30) days after the last day of the first two (2) months of each fiscal quarter of Borrower, a company prepared consolidated balance sheet and income statement covering Borrower's consolidated operations for such month certified by a Responsible Officer and in a form acceptable to Bank (the "Monthly Financial Statements");
- (d) within thirty (30) days after the last day of the first two (2) months of each fiscal quarter of Borrower and together with the Monthly Financial Statements, a duly completed Compliance Certificate signed by a Responsible Officer, certifying that as of the end of such month, Borrower was in full compliance with all of the terms and conditions of this Agreement, and setting forth calculations showing compliance with the financial covenants set forth in this Agreement and such other information as Bank may reasonably request, including, without limitation, a statement that at the end of such month there were no held checks;
- (e) as soon as available, and in any event within forty-five (45) days after the end of each fiscal quarter of Borrower, (i) company prepared consolidated balance sheet and income statement covering Borrower's consolidated operations for such quarter certified by a Responsible Officer and in a form acceptable to Bank, and (ii) a Compliance Certificate;
- (f) within thirty (30) days after the end of each fiscal year of Borrower, or more frequently as updated by Borrower's board of directors, (A) annual operating budgets (including income statements, balance sheets and cash flow statements, by month) for the upcoming fiscal year of Borrower, and (B) annual financial projections for the

following fiscal year (on a quarterly basis) as approved by Borrower's board of directors, together with any related business forecasts used in the preparation of such annual financial projections;

- (g) as soon as available, and in any event within one hundred fifty (150) days following the end of Borrower's fiscal year, audited consolidated financial statements prepared under GAAP, consistently applied, together with an unqualified opinion on the financial statements from KPMG LLP, or such other independent certified public accounting firm reasonably acceptable to Bank;
- (h) for so long as Borrower is subject to the reporting requirements under the Exchange Act within five (5) days of filing, copies of all periodic and other reports, proxy statements and other materials filed by Borrower with the SEC, any Governmental Authority succeeding to any or all of the functions of the SEC or with any national securities exchange, or distributed to its shareholders, as the case may be. Documents required to be delivered pursuant to the terms hereof (to the extent any such documents are included in materials otherwise filed with the SEC) may be delivered electronically and if so delivered, shall be deemed to have been delivered on the date on which Borrower posts such documents, or provides a link thereto, on Borrower's website on the Internet at Borrower's website address; provided, however, Borrower shall promptly notify Bank in writing (which may be by electronic mail) of the posting of any such documents;
- (i) within five (5) days of delivery, copies of all material statements, reports and notices made available to Borrower's security holders or to any holders of Subordinated Debt which constitutes Material Indebtedness;
- (j) prompt report of any legal actions pending or threatened in writing against Borrower or any of its Subsidiaries that would reasonably be expected to result in damages to Borrower or any of its Subsidiaries of, individually or in the aggregate, Two Hundred Fifty Thousand Dollars (\$250,000) or more:
- (k) within (7) days of Borrower's receipt, copies of all BASF Requests (as defined in the Supply Agreement) or other requests (other than as it relates to credits for product purchases) made by BASF under the Supply Agreement for payment of any Pre-Payment Balance (as defined in the Supply Agreement) or repayment (other than as it relates to credits for product purchases) of any other prepayment amount under the Supply Agreement; and
 - (l) other financial information reasonably requested by Bank.

6.3 Accounts Receivable

- (a) Schedules and Documents Relating to Accounts. Borrower shall deliver to Bank transaction reports and schedules of collections, as provided in Section 6.2, on Bank's standard forms; provided, however, that Borrower's failure to execute and deliver the same shall not affect or limit Bank's Lien and other rights in all of Borrower's Accounts, nor shall Bank's failure to advance or lend against a specific Account affect or limit Bank's Lien and other rights therein. If reasonably requested by Bank, Borrower shall furnish Bank with copies (or, at Bank's request after the occurrence and during the continuance of an Event of Default, to the extent available using commercially reasonable efforts, originals) of all contracts, orders, invoices, and other similar documents, and all shipping instructions, delivery receipts, bills of lading, and other evidence of delivery, for any goods the sale or disposition of which gave rise to such Accounts. In addition, Borrower shall deliver to Bank, on its reasonable request, to the extent available using commercially reasonable efforts, the originals of all instruments, chattel paper, security agreements, guarantees and other documents and property evidencing or securing any Accounts, in the same form as received, with all necessary endorsements, and copies of all credit memos.
- (b) <u>Disputes</u>. Borrower shall promptly notify Bank of all disputes or claims relating to Accounts, to the extent such disputes or claims involve amounts in excess of Two Hundred Fifty Thousand Dollars (\$250,000) in the aggregate for all Account Debtors. Borrower may forgive (completely or partially), compromise, or settle any Account for less than payment in full, or agree to do any of the foregoing so long as (i) Borrower does so in good faith, in a commercially reasonable manner, in the ordinary course of business, in arm's-length transactions, and reports the same to Bank in the regular reports provided to Bank; (ii) no Event of Default has occurred and is

continuing; and (iii) after taking into account all such discounts, settlements and forgiveness, no Overadvance will result.

- (c) <u>Collection of Accounts</u>. Borrower shall direct Account Debtors to deliver or transmit all proceeds of Accounts into a lockbox account, or such other "blocked account" as specified by Bank (either such account, the "Cash Collateral Account"). Whether or not an Event of Default has occurred and is continuing, Borrower shall immediately deliver all payments on and proceeds of Accounts to the Cash Collateral Account. All amounts received in the Cash Collateral Account shall be (i) subject to the Bank's right to maintain a reserve pursuant to Section 6.3(g), applied to immediately reduce the Obligations when a Streamline Period is not in effect (unless Bank, in its sole discretion, elects not to so apply such amounts), or (ii) transferred on a daily basis to Borrower's operating account with Bank when a Streamline Period is in effect. Borrower hereby authorizes Bank to transfer to the Cash Collateral Account any amounts that Bank reasonably determines are proceeds of the Accounts (provided that Bank is under no obligation to do so and this allowance shall in no event relieve Borrower of its obligations hereunder).
- (d) Returns. Provided no Event of Default has occurred and is continuing, if any Account Debtor returns any Inventory having an aggregate value in excess of Two Hundred Fifty Thousand Dollars (\$250,000) to Borrower, Borrower shall promptly (i) use commercially reasonable efforts to determine the reason for such return, (ii) issue a credit memorandum to the Account Debtor in the appropriate amount, and (iii) provide a copy of such credit memorandum to Bank, upon request from Bank. In the event any attempted return occurs after the occurrence and during the continuance of any Event of Default, Borrower shall immediately notify Bank of the return of the Inventory.
- (e) <u>Verifications; Confirmations; Credit Quality; Notifications</u>. Bank may, from time to time, after consultation with the Borrower, verify and confirm directly with the respective Account Debtors the validity, amount and other matters relating to the Accounts, either in the name of Borrower or Bank or such other name as Bank may choose, and notify any Account Debtor of Bank's security interest in such Account.
- (f) No Liability. Bank shall not be responsible or liable for any shortage or discrepancy in, damage to, or loss or destruction of, any goods, the sale or other disposition of which gives rise to an Account, or for any error, act, omission, or delay of any kind occurring in the settlement, failure to settle, collection or failure to collect any Account, or for settling any Account in good faith for less than the full amount thereof, nor shall Bank be deemed to be responsible for any of Borrower's obligations under any contract or agreement giving rise to an Account. Nothing herein shall, however, relieve Bank from liability for its own gross negligence or willful misconduct.
- (g) Reserves. Notwithstanding any terms in this Agreement to the contrary, at times when an Event of Default exists, Bank may hold any proceeds of the Accounts and any amounts in the Cash Collateral Account that are not applied to the Obligations pursuant to Section 6.3(c) above (including amounts otherwise required to be transferred to Borrower's operating account with Bank when a Streamline Period is in effect) as a reserve to be applied to any Obligations regardless of whether such Obligations are then due and payable.
- **Remittance of Proceeds.** Except as otherwise provided in Section 6.3(c), deliver, in kind, all proceeds arising from the disposition of any Collateral to Bank in the original form in which received by Borrower not later than the following Business Day after receipt by Borrower, to be applied to the Obligations (a) prior to an Event of Default, pursuant to the terms of Section 2.6(b) hereof, and (b) after the occurrence and during the continuance of an Event of Default, pursuant to the terms of Section 9.4 hereof; provided that, if no Event of Default has occurred and is continuing, Borrower shall not be obligated to remit to Bank the proceeds of the sale of surplus, worn out or obsolete Equipment disposed of by Borrower in good faith in an arm's length transaction for an aggregate purchase price of Five Hundred Thousand Dollars (\$500,000) or less (for all such transactions in any fiscal year). Borrower agrees that it will maintain all proceeds of Collateral in an account maintained with Bank. Nothing in this Section limits the restrictions on disposition of Collateral set forth elsewhere in this Agreement.
- 6.5 Taxes; Pensions. Timely file, and require each of its Subsidiaries to timely file, all required tax returns and reports and timely pay, and require each of its Subsidiaries to timely pay, all foreign, federal, state and material local taxes, assessments, deposits and contributions owed by Borrower and each of its Subsidiaries, except for deferred payment of any taxes contested pursuant to the terms of Section 5.9 hereof, and shall deliver to Bank,

within five (5) days, appropriate certificates attesting to such payments, and pay all amounts necessary to fund all present pension, profit sharing and deferred compensation plans in accordance with their terms, except as would not reasonably be expected to result in any liability to Borrower in an amount in excess of \$100,000.

6.6 Access to Collateral; Books and Records. At reasonable times, on one (1) Business Day's notice (provided no notice is required if an Event of Default has occurred and is continuing), Bank, or its agents, shall have the right to inspect the Collateral and the right to audit and copy Borrower's Books. The foregoing inspections and audits shall be conducted no more often than once every twelve (12) months unless an Event of Default has occurred and is continuing in which case such inspections and audits shall occur as often as Bank shall determine is necessary. The foregoing inspections and audits shall be conducted at Borrower's expense and the charge therefor shall be One Thousand Dollars (\$1,000) per person per day (or such higher amount as shall represent Bank's then-current standard charge for the same), plus reasonable out-of-pocket expenses. In the event Borrower and Bank schedule an audit more than five (5) days in advance, and Borrower cancels or seeks to or reschedules the audit with less than five (5) days written notice to Bank, then (without limiting any of Bank's rights or remedies) Borrower shall reimburse Bank for any costs incurred by Bank, plus any out-of-pocket expenses directly relating to the cancellation or rescheduling.

6.7 Insurance.

- (a) Keep its business and the Collateral insured for risks and in amounts standard for companies in Borrower's industry and location and as Bank may reasonably request. Insurance policies shall be in a form, with financially sound and reputable insurance companies that are not Affiliates of Borrower, and in amounts that are reasonably satisfactory to Bank. All property policies insuring the Collateral shall have a lender's loss payable endorsement showing Bank as a lender loss payee. All liability policies shall show, or have endorsements showing, Bank as an additional insured. Bank shall be named as lender loss payee and/or additional insured with respect to any such insurance providing coverage in respect of any Collateral. Bank acknowledges that BASF, or its designee, may be named as an additional loss payee and additional insured on any and all such insurance policies during any time that the Supply Agreement and related documents remains in effect.
- (b) Ensure that proceeds payable under any property policy for any Collateral are, at Bank's option, payable to Bank on account of the Obligations. Notwithstanding the foregoing, (a) so long as no Event of Default has occurred and is continuing, Borrower shall have the option of applying the proceeds of any casualty policy up to Two Hundred Fifty Thousand Dollars (\$250,000) with respect to any loss, but not exceeding Five Hundred Thousand Dollars (\$500,000) in the aggregate for all losses under all casualty policies in any one year, toward the replacement or repair of destroyed or damaged property; provided that any such replaced or repaired property (i) shall be of equal or like value as the replaced or repaired Collateral and (ii) shall be deemed Collateral in which Bank has been granted a first priority security interest, and (b) after the occurrence and during the continuance of an Event of Default, all proceeds payable under such casualty policy shall, at the option of Bank, be payable to Bank on account of the Obligations.
- (c) At Bank's request, Borrower shall deliver certificates of insurance policies and evidence of all premium payments. Each provider of any such insurance required under this Section 6.7 shall agree, by endorsement upon the policy or policies issued by it or by independent instruments furnished to Bank, that it will give Bank thirty (30) days prior written notice before any such policy or policies shall be materially altered or canceled. If Borrower fails to obtain insurance as required under this Section 6.7 or to pay any amount or furnish any required proof of payment to third persons and Bank, Bank may make all or part of such payment or obtain such insurance policies required in this Section 6.7, and take any action under the policies Bank deems prudent.

6.8 Operating Accounts.

- (a) Borrower, any Subsidiary of Borrower and any Guarantor shall maintain all of its operating accounts and excess cash with Bank or Bank's Affiliates, except with respect to accounts of Aspen Aerogels Germany GmbH with a balance of less than \$50,000 in the aggregate.
- (b) Provide Bank five (5) days prior written notice before establishing any Collateral Account at or with any bank or financial institution other than Bank or Bank's Affiliates. For each Collateral Account that Borrower at any time maintains, Borrower shall cause the applicable bank or financial institution (other than Bank) at

or with which any Collateral Account is maintained to execute and deliver a Control Agreement or other appropriate instrument customary to such other banks or financial institutions with respect to such Collateral Account to perfect Bank's Lien in such Collateral Account in accordance with the terms hereunder which Control Agreement may not be terminated without the prior written consent of Bank, provided that Control Agreements shall not be required for Collateral Accounts with a balance of less than \$50,000 individually or \$250,000 in the aggregate.

(c) Borrower, any Subsidiary of Borrower and any Guarantor shall obtain any business credit card exclusively from Bank.

6.9 Financial Covenants.

(a) <u>EBITDA</u>. Borrower shall achieve, measured as of the end of each fiscal quarter during the following periods, EBITDA of at least (loss not worse than) the following for the following periods:

Period	Minimum EBITDA (maximum loss)	
Trailing twelve (12) month period ending December 31, 2020	(\$7,000,000)	
Trailing three (3) month period ending March 31, 2021	(\$4,500,000)	
Trailing six (6) month period ending June 30, 2021	(\$7,500,000)	
Trailing nine (9) month period ending September 30, 2021	(\$9,800,000)	
Trailing twelve (12) month period ending December 31, 2021	(\$11,000,000)	

For the quarterly periods ending after December 31, 2021, the minimum EBITDA financial covenant thresholds shall be determined by Bank in its sole discretion on or before February 28, 2022 based on the Board-approved projections delivered to Bank pursuant to Section 6.2(f) hereof; provided further, that failure to timely deliver such Board-approved projections in accordance with Section 6.2(f) shall result in an immediate Event of Default for which no cure or grace period shall apply.

(b) Adjusted Quick Ratio. Borrower shall maintain at all times, to be tested as of the last day of each month, an Adjusted Quick Ratio of at least 1.20 to 1.00.

6.10 Protection of Intellectual Property Rights.

- (a) Except as would not reasonably be expected to cause a Material Adverse Change, (i) take such action as, in its reasonable business judgment, it deems necessary to protect, defend and maintain the validity and enforceability of its Intellectual Property; (ii) promptly advise Bank in writing of material infringements of its Intellectual Property; and (iii) not take any action or omit to take any action which would reasonably be expected to result in any Intellectual Property being abandoned, forfeited or dedicated to the public without Bank's written consent.
- (b) Provide written notice to Bank within ten (10) days of entering or becoming bound by any Restricted License which constitutes a Material Contract (other than over-the-counter software that is commercially available to the public). Upon the occurrence and during the continuance of an Event of Default, Borrower shall take such steps as Bank reasonably requests to obtain the consent of, or waiver by, any person whose consent or waiver is necessary for (i) any Restricted License which constitutes a Material Contract to be deemed "Collateral" and for Bank to have a security interest in it that might otherwise be restricted or prohibited by law or by the terms of any such

Restricted License, whether now existing or entered into in the future, and (ii) Bank to have the ability in the event of a liquidation of any Collateral to dispose of such Collateral in accordance with Bank's rights and remedies under this Agreement and the other Loan Documents.

- **6.11 Litigation Cooperation.** From the date hereof and continuing through the termination of this Agreement, make available to Bank, without expense to Bank, Borrower and its officers, employees and agents and Borrower's Books, to the extent that Bank may deem them reasonably necessary to prosecute or defend any third-party suit or proceeding instituted by or against Bank with respect to any Collateral or relating to Borrower.
- 6.12 Formation or Acquisition of Subsidiaries. Notwithstanding and without limiting the negative covenants contained in Sections 7.3 and 7.7 hereof, in the event Borrower or any Guarantor creates or acquires any Subsidiary (including, without limitation, pursuant to a Division), Borrower and such Guarantor shall, prior to the creation or acquisition of such new Subsidiary, promptly notify the Bank thereof and, at Bank's request, in its sole discretion, take all such action as may be reasonably required by Bank to (a) cause each such Subsidiary to, in Bank's sole discretion, become a co-borrower or Guarantor hereunder, together with such appropriate financing statements and/or Control Agreements, all in form and substance satisfactory to Bank (including being sufficient to grant Bank a first priority Lien (subject to Permitted Liens) in and to the assets of such newly formed or acquired Subsidiary), (b) provide to Bank appropriate certificates and powers and financing statements, pledging all of the direct or beneficial ownership interest in such new Subsidiary, in form and substance satisfactory to Bank; provided, that with respect to any Foreign Subsidiary, Borrower shall only be required to grant and pledge to Bank a perfected security interest in up to sixty-five percent (65%) of the stock, units or other evidence of ownership of such Foreign Subsidiary; and (c) provide to Bank all other documentation in form and substance satisfactory to Bank, including one or more opinions of counsel satisfactory to Bank, which in its opinion is appropriate with respect to the execution and delivery of the applicable documentation referred to above. Any document, agreement, or instrument executed or issued pursuant to this Section 6.12 shall be a Loan Document.
- **6.13 Further Assurances**. Execute any further instruments and take further action as Bank reasonably requests to perfect or continue Bank's Lien in the Collateral or to effect the purposes of this Agreement unless specifically waived in writing by Bank. Borrower shall deliver to Bank, within five (5) days after the same are sent or received, copies of all correspondence, reports, documents and other filings with any Governmental Authority regarding compliance with or maintenance of Governmental Approvals or Requirements of Law or that could reasonably be expected to cause a Material Adverse Change.
- **6.14 Online Banking.** Utilize Bank's online banking platform for all matters reasonably requested by Bank which shall include, without limitation (and without request by Bank for the following matters), uploading information pertaining to Accounts and Account Debtors, requesting approval for exceptions, requesting Credit Extensions, and uploading financial statements and other reports required to be delivered pursuant to the terms of this Agreement.

7 NEGATIVE COVENANTS

Borrower shall not do any of the following without Bank's prior written consent:

- 7.1 **Dispositions**. Convey, sell, lease, transfer, assign, or otherwise dispose of (including, without limitation, pursuant to a Division) (collectively, "**Transfer**"), or permit any of its Subsidiaries to Transfer, all or any part of its business or property, except for Transfers (a) of Inventory in the ordinary course of business; (b) of worn out or obsolete Equipment; (c) consisting of Permitted Liens and Permitted Investments; and (d) of non-exclusive licenses for the use of the property of Borrower or its Subsidiaries in the ordinary course of business.
- 7.2 Changes in Business, Management, Ownership, or Business Locations. (a) Engage in or permit any of its Subsidiaries, if any, to engage in any business other than the businesses currently engaged in by Borrower and such Subsidiary, as applicable, or reasonably related thereto; (b) liquidate or dissolve; or (c) (i) both of the Key Persons cease to hold such offices with Borrower and replacements satisfactory to Bank are not made within one hundred twenty (120) days after each such Key Person's departure from Borrower; or (ii) enter into any transaction or series of related transactions in which the stockholders of Borrower who were not stockholders immediately prior

to the first such transaction own more than forty percent (40%) of the voting stock of Borrower immediately after giving effect to such transaction or related series of such transactions (other than by the sale of Borrower's equity securities in a public offering or to venture capital or private equity investors so long as Borrower identifies to Bank the venture capital or private equity investors at least seven (7) Business Days prior to the closing of the transaction and provides to Bank a description of the material terms of the transaction).

Borrower shall not, without at least ten (10) days prior written notice to Bank: (1) add any new offices or business locations, including warehouses (unless such new offices or business locations contain less than Two Hundred Fifty Thousand Dollars (\$250,000) in Borrower's assets or property) or deliver any portion of the Collateral valued, individually or in the aggregate, in excess of Two Hundred Fifty Thousand Dollars (\$250,000) to a bailee at a location other than to a bailee and at a location already disclosed in the Perfection Certificate or for which a bailee agreement has been executed, (2) change its jurisdiction of organization, (3) change its organizational structure or type, (4) change its legal name, or (5) change any organizational number (if any) assigned by its jurisdiction of organization. If Borrower intends to deliver any portion of the Collateral valued, individually or in the aggregate, in excess of Two Hundred Fifty Thousand Dollars (\$250,000) to a bailee, and Bank and such bailee are not already parties to a bailee agreement governing both the Collateral and the location to which Borrower intends to deliver the Collateral, then Borrower will first receive the written consent of Bank, and such bailee shall execute and deliver a bailee agreement in form and substance satisfactory to Bank in its reasonable discretion.

- 7.3 Mergers or Acquisitions. Merge or consolidate, or permit any of its Subsidiaries to merge or consolidate, with any other Person, or acquire, or permit any of its Subsidiaries to acquire, all or substantially all of the capital stock or property of another Person (including, without limitation, by the formation of any Subsidiary or pursuant to a Division). A Subsidiary may merge or consolidate into another Subsidiary or into Borrower.
 - 7.4 Indebtedness. Create, incur, assume, or be liable for any Indebtedness, or permit any Subsidiary to do so, other than Permitted Indebtedness.
- 7.5 Encumbrance. Create, incur, allow, or suffer any Lien (other than Permitted Liens) on any of its property, or assign or convey any right to receive income, including the sale of any Accounts, or permit any of its Subsidiaries to do so, except for Permitted Liens. Borrower shall not permit any Collateral to be subject to any Liens other than the first priority security interest granted herein or Permitted Liens, or enter into any agreement, document, instrument or other arrangement (except with or in favor of Bank except as otherwise permitted herein) with any Person which directly or indirectly prohibits or has the effect of prohibiting Borrower or any Subsidiary from assigning, mortgaging, pledging, granting a security interest in or upon, or encumbering any of Borrower's or any Subsidiary's Intellectual Property, except as is otherwise permitted in Section 7.1 hereof and in the definition of "Permitted Liens" herein or with respect to any Excluded Intellectual Property.
 - 7.6 Maintenance of Collateral Accounts. Maintain any Collateral Account except pursuant to the terms of Section 6.8(b) hereof.
- 7.7 **Distributions; Investments.** (a) Pay any dividends or make any distribution or payment or redeem, retire or purchase any capital stock; or (b) directly or indirectly make any Investment (including, without limitation, any additional Investment in any Subsidiary or by the formation of any Subsidiary) other than Permitted Investments, or permit any of its Subsidiaries to do so.
- 7.8 Transactions with Affiliates. Directly or indirectly enter into or permit to exist any material transaction with any Affiliate of Borrower (other than a Guarantor), except for transactions that are in the ordinary course of Borrower's business, upon fair and reasonable terms that are no less favorable to Borrower than would be obtained in an arm's length transaction with a non-affiliated Person.
- **7.9 Subordinated Debt.** (a) Make or permit any payment on any Subordinated Debt, except as permitted under the terms of the subordination, intercreditor, or other similar agreement to which such Subordinated Debt is subject, or (b) amend any provision in any document relating to the Subordinated Debt which would increase the amount thereof, or adversely affect the subordination thereof to Obligations owed to Bank.

- 7.10 Compliance. Become an "investment company" or a company controlled by an "investment company", under the Investment Company Act of 1940, as amended, or undertake as one of its important activities extending credit to purchase or carry margin stock (as defined in Regulation U of the Board of Governors of the Federal Reserve System), or use the proceeds of any Credit Extension for that purpose; fail to meet the minimum funding requirements of ERISA, permit a Reportable Event or non-exempt Prohibited Transaction, as defined in ERISA, to occur; fail to comply with the Federal Fair Labor Standards Act or violate any other law or regulation, if the violation could reasonably be expected to have a material adverse effect on Borrower's business, or permit any of its Subsidiaries to do so; withdraw or permit any Subsidiary to withdraw from participation in, permit partial or complete termination of, or permit the occurrence of any other event with respect to, any present pension, profit sharing and deferred compensation plan which could reasonably be expected to result in any liability of Borrower in an amount in excess of \$250,000, including any liability to the Pension Benefit Guaranty Corporation or its successors or any other governmental agency.
- 7.11 BASF Pre-Payment Balance. Make or permit any payment of any Pre-Payment Balance (as defined in the Supply Agreement) or other prepayment amount under the Supply Agreement, except that Borrower may make required payments of the Pre-Payment Balance under the Supply Agreement following a BASF Request (as defined in the Supply Agreement) so long as (A) an Event of Default has not occurred and is not continuing and would not exist immediately after such payment, and (B) immediately after giving effect to such payment, Borrower shall be in compliance with each of the covenants set forth in Section 6.9 (as to the most recent quarter ended with respect to Section 6.9(a) and as to the most recent month ended with respect to Section 6.9(b)), based upon financial statements delivered to Bank which give pro forma effect to the making of such payment.

8 EVENTS OF DEFAULT

Any one of the following shall constitute an event of default (an "Event of Default") under this Agreement:

8.1 Payment Default. Borrower fails to (a) make any payment of principal or interest on any Credit Extension on its due date, or (b) pay any other Obligations within three (3) Business Days after such Obligations are due and payable (which three (3) Business Day cure period shall not apply to payments due on the Revolving Line Maturity Date). During the cure period, the failure to make or pay any payment specified under clause (b) hereunder is not an Event of Default (but no Credit Extension will be made during the cure period);

8.2 Covenant Default.

- (a) Borrower fails or neglects to perform any obligation in Sections 6.2 (provided, however, Borrower shall have ten (10) Business Days from the scheduled due date to cure any default under clauses 6.2(b)-(d) and 6.2(i)), 6.5, 6.7(a), 6.8(a), 6.9, 6.10(b), 6.12, 6.13, or violates any covenant in Section 7; or
- (b) Borrower fails or neglects to perform, keep, or observe any other term, provision, condition, covenant or agreement contained in this Agreement or any Loan Documents, and as to any default (other than those specified in this Section 8) under such other term, provision, condition, covenant or agreement that can be cured, has failed to cure the default within ten (10) days after the occurrence thereof; provided, however, that if the default cannot by its nature be cured within the ten (10) day period or cannot after diligent attempts by Borrower be cured within such ten (10) day period, and such default is likely to be cured within a reasonable time, then Borrower shall have an additional period (which shall not in any case exceed thirty (30) days) to attempt to cure such default, and within such reasonable time period the failure to cure the default shall not be deemed an Event of Default (but no Credit Extensions shall be made during such cure period). Cure periods provided under this section shall not apply, among other things, to financial covenants or any other covenants set forth in clause (a) above;
 - **8.3 Material Adverse Change**. A Material Adverse Change occurs;

8.4 Attachment; Levy; Restraint on Business.

(a) (i) The service of process seeking to attach, by trustee or similar process, any funds of Borrower or of any entity under the control of Borrower (including a Subsidiary) on deposit or otherwise maintained with Bank or any Bank Affiliate, or (ii) a notice of lien or levy (other than a Permitted Lien) is filed against any of Borrower's assets by any Governmental Authority, and the same under subclauses (i) and (ii) hereof are not, within thirty (30) days after the occurrence thereof, discharged or stayed (whether through the posting of a bond or otherwise); provided, however, no Credit Extensions shall be made during any thirty (30) day cure period; or

(b) (i) any material portion of Borrower's assets is attached, seized, levied on, or comes into possession of a trustee or receiver, or (ii) any court order enjoins, restrains, or prevents Borrower from conducting any material part of its business;

- **8.5 Insolvency**. (a) Borrower and its Subsidiaries, taken as a whole, are unable to pay its debts (including trade debts) as they become due or otherwise becomes insolvent; (b) Borrower begins an Insolvency Proceeding; or (c) an Insolvency Proceeding is begun against Borrower and not dismissed or stayed within forty-five (45) days (but no Credit Extensions shall be made while any of the conditions described in clause (a) exist and/or until any Insolvency Proceeding is dismissed);
- **8.6 Other Agreements.** There is, under any Material Contract to which Borrower or any Guarantor is a party with a third party or parties, (a) any default resulting in a right by such third party or parties, whether or not exercised, to accelerate the maturity of any Material Indebtedness; or (b) any default by Borrower or Guarantor, the result of which would reasonably be expected to cause a Material Adverse Change;
- **8.7 Judgments**. One or more final judgments, orders or decrees for the payment of money in an amount, individually or in the aggregate, of at least Two Hundred Fifty Thousand Dollars (\$250,000) (not covered by independent third-party insurance as to which liability has been accepted by such insurance carrier) shall be rendered against Borrower and the same are not, within thirty (30) days after the entry thereof, discharged or after execution thereof, stayed or bonded pending appeal, or such judgments are not discharged prior to the expiration of any such stay (provided that no Credit Extensions will be made prior to the discharge, stay, or bonding of such judgment, order or decree);
- **8.8 Misrepresentations**. Borrower or any Responsible Officer makes any representation, warranty, or other statement now or later in this Agreement, any Loan Document or in any writing delivered to Bank or to induce Bank to enter this Agreement or any Loan Document, and such representation, warranty, or other statement is incorrect in any material respect when made;
- **8.9 Subordinated Debt.** Any document, instrument, or agreement evidencing the subordination of any Subordinated Debt to the Obligations shall for any reason be revoked or invalidated or otherwise cease to be in full force and effect, any Person shall be in breach thereof or contest in any manner the validity or enforceability thereof or deny that it has any further liability or obligation thereunder, or the Obligations shall for any reason be subordinated or shall not have the priority contemplated by this Agreement;
- **8.10 Guaranty.** (a) Any guaranty of any Obligations terminates or ceases for any reason to be in full force and effect which could reasonably be expected to have a material adverse effect on the ability of the Borrower and its Subsidiaries, taken as a whole, to repay the Obligations; (b) any Guarantor does not perform any obligation or covenant under any guaranty of the Obligations which could reasonably be expected to have a material adverse effect on the ability of the Borrower and its Subsidiaries, taken as a whole, to repay the Obligations; (c) any circumstance described in Sections 8.3, 8.4, 8.5, 8.7, or 8.8 occurs with respect to any Guarantor which could reasonably be expected to have a material adverse effect on the ability of the Borrower and its Subsidiaries, taken as a whole, to repay the Obligations, (d) the liquidation, winding up, or termination of existence of any Guarantor; or (e) a material impairment in the perfection or priority of Bank's Lien in the collateral provided by Guarantor or in the value of such Collateral; or

	8.11	Governmental Approvals. Any Governmental Approval shall have been (a) revoked, rescinded, suspended, modified in an adverse manner
or not re	newed in the o	rdinary course for a full term or (b) subject to any decision by a Governmental Authority that designates a hearing with respect to any
application	ons for renewal	of any of such Governmental Approval or that could result in the Governmental Authority taking any of the actions described in clause (a
above, ar	nd, in each case,	such decision or such revocation, rescission, suspension, modification or non-renewal has, or could reasonably be expected to have, a Materia
Adverse	Change.	

9 BANK'S RIGHTS AND REMEDIES

- **9.1 Rights and Remedies.** When an Event of Default has occurred and is continuing, Bank may, without notice or demand, do any or all of the following:
- (a) declare all Obligations immediately due and payable (but if an Event of Default described in Section 8.5 occurs all Obligations are immediately due and payable without any action by Bank);
- (b) stop advancing money or extending credit for Borrower's benefit under this Agreement or under any other agreement between Borrower and Bank;
- demand that Borrower (i) deposit cash with Bank in an amount equal to at least 105% (110% in the case of any Letter of Credit denominated in a Foreign Currency) of the Dollar Equivalent of the aggregate face amount of all Letters of Credit remaining undrawn (plus all interest, fees, and costs due or to become due in connection therewith (as estimated by Bank in its good faith business judgment)), to secure all of the Obligations relating to such Letters of Credit, as collateral security for the repayment of any future drawings under such Letters of Credit, and Borrower shall forthwith deposit and pay such amounts, and (ii) pay in advance all letter of credit fees scheduled to be paid or payable over the remaining term of any Letters of Credit; provided, however, if an Event of Default described in Section 8.5 occurs, the obligations of Borrower to cash collateralize all Letters of Credit remaining undrawn shall automatically become effective without any action by Bank;
 - (d) terminate any FX Contracts;
- (e) verify the amount of, demand payment of and performance under, and collect any Accounts and General Intangibles, settle or adjust disputes and claims directly with Account Debtors for amounts on terms and in any order that Bank considers advisable, and notify any Person owing Borrower money of Bank's security interest in such funds;
- (f) make any payments and do any acts it considers necessary or reasonable to protect the Collateral and/or its security interest in the Collateral. Borrower shall assemble the Collateral if Bank requests and make it available as Bank designates. Bank may enter premises where the Collateral is located, take and maintain possession of any part of the Collateral, and pay, purchase, contest, or compromise any Lien which appears to be prior or superior to its security interest and pay all expenses incurred. Borrower grants Bank a license to enter and occupy any of its premises, without charge, to exercise any of Bank's rights or remedies;
- (g) apply to the Obligations any (i) balances and deposits of Borrower it holds, or (ii) amount held by Bank owing to or for the credit or the account of Borrower;
- (h) ship, reclaim, recover, store, finish, maintain, repair, prepare for sale, advertise for sale, and sell the Collateral. Bank is hereby granted a non-exclusive, royalty-free license or other right to use, without charge, Borrower's labels, Patents, Copyrights, mask works, rights of use of any name, trade secrets, trade names, Trademarks, and advertising matter, or any similar property as it pertains to the Collateral, in completing production of, advertising for sale, and selling any Collateral and, in connection with Bank's exercise of its rights under this Section, Borrower's rights under all licenses and all franchise agreements inure to Bank's benefit;
- (i) place a "hold" on any Collateral Account maintained with Bank and/or deliver a notice of exclusive control, any entitlement order, or other directions or instructions pursuant to any Control Agreement or similar agreements providing control of any Collateral;

- (j) demand and receive possession of Borrower's Books; and
- (k) exercise all rights and remedies available to Bank under the Loan Documents or at law or equity, including all remedies provided under the Code (including disposal of the Collateral pursuant to the terms thereof).
- **9.2 Power of Attorney**. Borrower hereby irrevocably appoints Bank as its lawful attorney-in-fact, exercisable following the occurrence of an Event of Default, to: (a) endorse Borrower's name on any checks, payment instruments, or other forms of payment or security; (b) sign Borrower's name on any invoice or bill of lading for any Account or drafts against Account Debtors; (c) demand, collect, sue, and give releases to any Account Debtor for monies due, settle and adjust disputes and claims about the Accounts directly with Account Debtors, and compromise, prosecute, or defend any action, claim, case, or proceeding about any Collateral (including filing a claim or voting a claim in any bankruptcy case in Bank's or Borrower's name, as Bank chooses); (d) make, settle, and adjust all claims under Borrower's insurance policies; (e) pay, contest or settle any Lien, charge, encumbrance, security interest, or other claim in or to the Collateral, or any judgment based thereon, or otherwise take any action to terminate or discharge the same; and (f) transfer the Collateral into the name of Bank or a third party as the Code permits. Borrower hereby appoints Bank as its lawful attorney-in-fact to sign Borrower's name on any documents necessary to perfect or continue the perfection of Bank's security interest in the Collateral regardless of whether an Event of Default has occurred until all Obligations have been satisfied in full and Bank has no further obligation to make Credit Extensions hereunder. Bank's foregoing appointment as Borrower's attorney in fact, and all of Bank's rights and powers, coupled with an interest, are irrevocable until all Obligations have been fully repaid and performed and Bank has no further obligation to make Credit Extensions hereunder.
- 9.3 Protective Payments. If Borrower fails to obtain the insurance called for by Section 6.7 or fails to pay any premium thereon or fails to pay any other amount which Borrower is obligated to pay under this Agreement or any other Loan Document, Bank may obtain such insurance or make such payment, and all amounts so paid by Bank are Bank Expenses and immediately due and payable, bearing interest at the then highest rate applicable to the Obligations, and secured by the Collateral. Bank will make reasonable efforts to provide Borrower with notice of Bank obtaining such insurance at the time it is obtained or within a reasonable time thereafter. No payments by Bank are deemed an agreement to make similar payments in the future or Bank's waiver of any Event of Default.
- 9.4 Application of Payments and Proceeds. If an Event of Default has occurred and is continuing, Bank may apply any funds in its possession in any Collateral Account, whether from Borrower account balances, payments, proceeds realized as the result of any collection of Accounts or other disposition of the Collateral, or otherwise, to the Obligations in such order as Bank shall determine in its sole discretion. Any surplus shall be paid to Borrower or to other Persons legally entitled thereto; Borrower shall remain liable to Bank for any deficiency. If Bank, in its good faith business judgment, directly or indirectly, enters into a deferred payment or other credit transaction with any purchaser at any sale of Collateral, Bank shall have the option, exercisable at any time, of either reducing the Obligations by the principal amount of the purchase price or deferring the reduction of the Obligations until the actual receipt by Bank of cash therefor.
- 9.5 Bank's Liability for Collateral. So long as Bank complies with reasonable banking practices regarding the safekeeping of the Collateral in the possession or under the control of Bank, Bank shall not be liable or responsible for: (a) the safekeeping of the Collateral; (b) any loss or damage to the Collateral; (c) any diminution in the value of the Collateral; or (d) any act or default of any carrier, warehouseman, bailee, or other Person. Borrower bears all risk of loss, damage or destruction of the Collateral.
- 9.6 No Waiver; Remedies Cumulative. Bank's failure, at any time or times, to require strict performance by Borrower of any provision of this Agreement or any other Loan Document shall not waive, affect, or diminish any right of Bank thereafter to demand strict performance and compliance herewith or therewith. No waiver hereunder shall be effective unless signed by the party granting the waiver and then is only effective for the specific instance and purpose for which it is given. Bank's rights and remedies under this Agreement and the other Loan Documents are cumulative. Bank has all rights and remedies provided under the Code, by law, or in equity. Bank's exercise of one right or remedy is not an election and shall not preclude Bank from exercising any other remedy under this Agreement or other remedy available at law or in equity, and Bank's waiver of any Event of Default is not a continuing waiver. Bank's delay in exercising any remedy is not a waiver, election, or acquiescence.

9.7 Demand Waiver. Borrower waives demand, notice of default or dishonor, notice of payment and nonpayment, notice of any default, nonpayment at maturity, release, compromise, settlement, extension, or renewal of accounts, documents, instruments, chattel paper, and guarantees held by Bank on which Borrower is liable.

10 NOTICES

All notices, consents, requests, approvals, demands, or other communication (collectively, "Communication"), other than Advance requests made pursuant to Section 3.4, by any party to this Agreement or any other Loan Document must be in writing and be delivered or sent by facsimile at the addresses or facsimile numbers listed below. Bank or Borrower may change its notice address by giving the other party written notice thereof. Each such Communication shall be deemed to have been validly served, given, or delivered: (a) upon the earlier of actual receipt and three (3) Business Days after deposit in the U.S. mail, registered or certified mail, return receipt requested, with proper postage prepaid; (b) upon transmission, when sent by facsimile transmission (with such facsimile promptly confirmed by delivery of a copy by personal delivery or United States mail as otherwise provided in this Section 10); (c) one (1) Business Day after deposit with a reputable overnight courier with all charges prepaid; or (d) when delivered, if hand-delivered by messenger, all of which shall be addressed to the party to be notified and sent to the address or facsimile number indicated below. Advance requests made pursuant to Section 3.4 must be in writing and may be in the form of electronic mail, delivered to Bank by Borrower at the e-mail address of Bank provided below and shall be deemed to have been validly served, given, or delivered when sent (with such electronic mail promptly confirmed by delivery of a copy by personal delivery or United States mail as otherwise provided in this Section 10). Bank or Borrower may change its address, facsimile number, or electronic mail address by giving the other party written notice thereof in accordance with the terms of this Section 10.

If to Borrower: Aspen Aerogels, Inc. 30 Forbes Road, Building B Northborough, Massachusetts 01532 Attn: John F. Fairbanks Fax: (508) 691-1200

Email: jfairbanks@aerogels.com

If to Bank: Silicon Valley Bank

275 Grove Street, Suite 2-200 Newton, Massachusetts 02466

Attn: C.J. Bradford Email: cbradford@svb.com

with a copy to: Morrison & Foerster LLP

200 Clarendon Street, 20th Floor Boston, Massachusetts 02116 Attention: Charles W. Stavros, Esq.

E-Mail: cstavros@mofo.com

11 Choice of Law, Venue, Jury Trial Waiver

Massachusetts law governs the Loan Documents without regard to principles of conflicts of law. Borrower and Bank each submit to the exclusive jurisdiction of the State and Federal courts in Massachusetts; provided, however, that nothing in this Agreement shall be deemed to operate to preclude Bank from bringing suit or taking other legal action in any other jurisdiction to realize on the Collateral or any other security for the Obligations, or to enforce a judgment or other court order in favor of Bank. Borrower expressly submits and consents in advance to such jurisdiction in any action or suit commenced in any such court, and Borrower hereby waives any objection that it may have based upon lack of personal jurisdiction, improper venue, or forum non conveniens and hereby consents to the granting of such legal or equitable relief as is deemed appropriate by such court. Borrower hereby waives

personal service of the summons, complaints, and other process issued in such action or suit and agrees that service of such summons, complaints, and other process may be made by registered or certified mail addressed to Borrower at the address set forth in Section 10 of this Agreement and that service so made shall be deemed completed upon the earlier to occur of Borrower's actual receipt thereof or three (3) days after deposit in the U.S. mails, proper postage prepaid.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, BORROWER AND BANK EACH WAIVE THEIR RIGHT TO A JURY TRIAL OF ANY CLAIM OR CAUSE OF ACTION ARISING OUT OF OR BASED UPON THIS AGREEMENT, THE LOAN DOCUMENTS OR ANY CONTEMPLATED TRANSACTION, INCLUDING CONTRACT, TORT, BREACH OF DUTY AND ALL OTHER CLAIMS. THIS WAIVER IS A MATERIAL INDUCEMENT FOR BOTH PARTIES TO ENTER INTO THIS AGREEMENT. EACH PARTY HAS REVIEWED THIS WAIVER WITH ITS COUNSEL.

This Section 11 shall survive the termination of this Agreement.

12 GENERAL PROVISIONS

- 12.1 Termination Prior to Revolving Line Maturity Date; Survival. All covenants, representations and warranties made in this Agreement shall continue in full force until this Agreement has terminated pursuant to its terms and all Obligations have been satisfied. So long as Borrower has satisfied the Obligations (other than inchoate indemnity obligations, any other obligation which, by their terms, are to survive the termination of this Agreement, and any Obligations under Bank Services Agreements that are cash collateralized in accordance with Section 4.1 of this Agreement), this Agreement may be terminated prior to the Revolving Line Maturity Date by Borrower, effective three (3) Business Days after written notice of termination is given to Bank. Those obligations that are expressly specified in this Agreement as surviving this Agreement's termination shall continue to survive notwithstanding this Agreement's termination.
- 12.2 Successors and Assigns. This Agreement binds and is for the benefit of the successors and permitted assigns of each party. Borrower may not assign this Agreement or any rights or obligations under it without Bank's prior written consent (which may be granted or withheld in Bank's discretion). Bank has the right, without the consent of or notice to Borrower, to sell, transfer, assign, negotiate, or grant participation in all or any part of, or any interest in, Bank's obligations, rights, and benefits under this Agreement and the other Loan Documents; provided, that, prior to the occurrence and during the continuance of an Event of Default, any such sale, transfer, assignment, negotiation or grant of a participation to a Person or entity other than an institutional lender shall require Borrower's prior written consent, such consent not to be unreasonably withheld.
- 12.3 Indemnification. Borrower agrees to indemnify, defend and hold Bank and its directors, officers, employees, agents, attorneys, or any other Person affiliated with or representing Bank (each, an "Indemnified Person") harmless against: (i) all obligations, demands, claims, and liabilities (collectively, "Claims") claimed or asserted by any other party in connection with the transactions contemplated by the Loan Documents; and (ii) all losses or expenses (including Bank Expenses) in any way suffered, incurred, or paid by such Indemnified Person as a result of, following from, consequential to, or arising from transactions between Bank and Borrower contemplated by the Loan Documents (including reasonable attorneys' fees and expenses), except for Claims and/or losses directly caused by such Indemnified Person's gross negligence or willful misconduct.

This Section 12.3 shall survive until all statutes of limitation with respect to the Claims, losses, and expenses for which indemnity is given shall have run.

- **12.4 Time of Essence**. Time is of the essence for the performance of all Obligations in this Agreement.
- 12.5 Severability of Provisions. Each provision of this Agreement is severable from every other provision in determining the enforceability of any provision.
- 12.6 Correction of Loan Documents. Bank may correct patent errors and fill in any blanks in the Loan Documents consistent with the agreement of the parties.

- Amendments in Writing; Waiver; Integration. No purported amendment or modification of any Loan Document, or waiver, discharge or termination of any obligation under any Loan Document, shall be enforceable or admissible unless, and only to the extent, expressly set forth in a writing signed by the party against which enforcement or admission is sought. Without limiting the generality of the foregoing, no oral promise or statement, nor any action, inaction, delay, failure to require performance or course of conduct shall operate as, or evidence, an amendment, supplement or waiver or have any other effect on any Loan Document. Any waiver granted shall be limited to the specific circumstance expressly described in it, and shall not apply to any subsequent or other circumstance, whether similar or dissimilar, or give rise to, or evidence, any obligation or commitment to grant any further waiver. The Loan Documents represent the entire agreement about this subject matter and supersede prior negotiations or agreements. All prior agreements, understandings, representations, warranties, and negotiations between the parties about the subject matter of the Loan Documents merge into the Loan Documents.
- 12.8 Counterparts. This Agreement may be executed in any number of counterparts and by different parties on separate counterparts, each of which, when executed and delivered, is an original, and all taken together, constitute one Agreement.
- 12.9 Confidentiality. In handling any confidential information, Bank shall exercise the same degree of care that it exercises for its own proprietary information, but disclosure of information may be made: (a) to Bank's Subsidiaries or Affiliates (such Subsidiaries and Affiliates, together with Bank, collectively, "Bank Entities"); (b) to prospective transferees or purchasers of any interest in the Credit Extensions (provided, however, Bank shall use commercially reasonable efforts to obtain any prospective transferee's or purchaser's agreement to the terms of this provision; (c) as required by law, regulation, subpoena, or other order; (d) to Bank's regulators or as otherwise required in connection with Bank's examination or audit; (e) as Bank considers appropriate in exercising remedies under the Loan Documents; and (f) to third-party service providers of Bank so long as such service providers have executed a confidentiality agreement with Bank with terms no less restrictive than those contained herein. Confidential information does not include information that is either: (i) in the public domain or in Bank's possession when disclosed to Bank, or becomes part of the public domain after disclosure to Bank; or (ii) disclosed to Bank by a third party, if Bank does not know that the third party is prohibited from disclosing the information.

Bank Entities may use the confidential information for reporting purposes and the development and distribution of databases and market analyses so long as such confidential information is aggregated and anonymized prior to distribution, unless otherwise expressly permitted by Borrower. The provisions of the immediately preceding sentence shall survive the termination of this Agreement.

- 12.10 Attorneys' Fees, Costs and Expenses. In any action or proceeding between Borrower and Bank arising out of or relating to the Loan Documents, the Bank shall be entitled to recover its reasonable attorneys' fees and other costs and expenses incurred, in addition to any other relief to which it may be entitled.
- 12.11 Electronic Execution of Documents. The words "execution," "signed," "signature" and words of like import in any Loan Document shall be deemed to include electronic signatures or the keeping of records in electronic form, each of which shall be of the same legal effect, validity and enforceability as a manually executed signature or the use of a paper-based recordkeeping systems, as the case may be, to the extent and as provided for in any applicable law, including, without limitation, any state law based on the Uniform Electronic Transactions Act.
- Right of Setoff. Borrower hereby grants to Bank a Lien and a right of setoff as security for all Obligations to Bank, whether now existing or hereafter arising upon and against all deposits held in Collateral Accounts, credits, collateral and property, now or hereafter in the possession, custody, safekeeping or control of Bank or any entity under the control of Bank (including a subsidiary of Bank) or in transit to any of them. At any time after the occurrence and during the continuance of an Event of Default, without demand or notice, Bank may setoff the same or any part thereof and apply the same to any liability or Obligation of Borrower even though unmatured and regardless of the adequacy of any other collateral securing the Obligations. ANY AND ALL RIGHTS TO REQUIRE BANK TO EXERCISE ITS RIGHTS OR REMEDIES WITH RESPECT TO ANY OTHER COLLATERAL WHICH SECURES THE OBLIGATIONS, PRIOR TO EXERCISING ITS RIGHT OF SETOFF WITH RESPECT TO SUCH DEPOSITS, CREDITS OR OTHER PROPERTY OF BORROWER, ARE HEREBY KNOWINGLY, VOLUNTARILY AND IRREVOCABLY WAIVED.

- 12.13 Captions. The headings used in this Agreement are for convenience only and shall not affect the interpretation of this Agreement.
- **12.14 Construction of Agreement**. The parties mutually acknowledge that they and their attorneys have participated in the preparation and negotiation of this Agreement. In cases of uncertainty this Agreement shall be construed without regard to which of the parties caused the uncertainty to exist.
- 12.15 Relationship. The relationship of the parties to this Agreement is determined solely by the provisions of this Agreement. The parties do not intend to create any agency, partnership, joint venture, trust, fiduciary or other relationship with duties or incidents different from those of parties to an arm's-length contract.
- 12.16 Third Parties. Nothing in this Agreement, whether express or implied, is intended to: (a) confer any benefits, rights or remedies under or by reason of this Agreement on any persons other than the express parties to it and their respective permitted successors and assigns; (b) relieve or discharge the obligation or liability of any person not an express party to this Agreement any right of subrogation or action against any party to this Agreement.
- No Novation. Borrower and Bank hereby agree that, effective upon the execution and delivery of this Agreement by each such party, the terms and provisions of the Prior Loan Agreement shall be and hereby are amended, restated and superseded in their entirety by the terms and provisions of this Agreement. Nothing herein contained shall be construed as a substitution or novation of the obligations of Borrower outstanding under the Prior Loan Agreement or instruments securing the same, which obligations shall remain in full force and effect, except to the extent that the terms thereof are modified hereby or by instruments executed concurrently herewith. Nothing expressed or implied in this Agreement shall be construed as a release or other discharge of any Borrower from any of the Obligations or any liabilities under the Prior Loan Agreement or any of the security agreements, pledge agreements, mortgages, guaranties or other Loan Documents executed in connection therewith. Borrower hereby (i) confirms and agrees that each Loan Document to which it is a party is, and shall continue to be, in full force and effect and is hereby ratified and confirmed in all respects except that on and after the Effective Date all references in any such Loan Document to the "Loan and Security Agreement", the "Loan Agreement" the "Agreement", "thereof", "thereof", "thereof", "thereunder" or words of like import referring to the Prior Loan Agreement or any Loan Document executed in connection therewith purports to assign or pledge to the Bank, or to grant to the Bank a Lien on, any collateral as security for the Obligations of Borrower from time to time existing in respect of the Prior Loan Agreement, such pledge, assignment or grant of the Lien is hereby ratified and confirmed in all respects and shall remain effective as of the first date it became effective.
- 12.18 Reaffirmation of Stock Pledge Agreement. Borrower hereby ratifies, confirms and reaffirms, all and singular, the terms and conditions of the Stock Pledge Agreement, including any exhibits and/or schedules attached thereto, as in effect prior to the date hereof and/or as entered into as of the date hereof, to which Borrower is a party, and Borrower's rights and obligations arising under the Stock Pledge Agreement. Borrower acknowledges, confirms and agrees that: (i) the Stock Pledge Agreement shall remain in full force and effect and shall in no way be limited by the execution of this Agreement or any other Loan Document, (ii) each reference in the Stock Pledge Agreement to the "Loan Agreement" shall mean the Prior Loan Agreement, as amended and restated by this Agreement, (iii) any "Pledged Collateral" pledged to Bank under the Stock Pledge Agreement shall continue to secure the repayment in full of the "Obligations" as defined herein, and (iv) Exhibit A of the Stock Pledge Agreement and the definition of "Shares" thereunder shall be deemed to include all of Borrower's right, title, and interest in Aspen Aerogels Georgia, LLC. Notwithstanding the foregoing, the Pledged Collateral does not include more than 65% of the presently existing and hereafter arising issued and outstanding shares of capital stock owned by Borrower of any Foreign Subsidiary which shares entitle the holder thereof to vote for directors or any other matter.

13 DEFINITIONS

13.1 **Definitions.** As used in the Loan Documents, the word "shall" is mandatory, the word "may" is permissive, the word "or" is not exclusive, the words "includes" and "including" are not limiting, the singular includes

the plural, and numbers denoting amounts that are setoff in brackets are negative. As used in this Agreement, the following capitalized terms have the following meanings:

- "Account" is any "account" as defined in the Code with such additions to such term as may hereafter be made, and includes, without limitation, all accounts receivable and other sums owing to Borrower.
 - "Account Debtor" is any "account debtor" as defined in the Code with such additions to such term as may hereafter be made.
- "Adjusted Quick Ratio" means a ratio of (i) Quick Assets <u>divided by</u> (ii) the sum of (a) Current Liabilities, <u>minus</u> (b) the current portion of Deferred Revenue, <u>minus</u> (c) the current portion of the PPP Forgivable Amount, <u>minus</u> (d) the current portion of any Pre-Payment Balance (as defined in the Supply Agreement) or any other prepayment amount under the Supply Agreement, <u>minus</u> (e) the Dollar Equivalent amount of all outstanding Letters of Credit, <u>plus</u> (f) the amount of any Pre-Payment Balance or any other prepayment amount due to BASF following a BASF Request (as defined in the Supply Agreement).
 - "Advance" or "Advances" means a revolving credit loan (or revolving credit loans) under the Revolving Line.
- "Affiliate" is, with respect to any Person, each other Person that owns or controls directly or indirectly the Person, any Person that controls or is controlled by or is under common control with the Person, and each of that Person's senior executive officers, directors, partners and, for any Person that is a limited liability company, that Person's managers and members.
 - "Agreement" is defined in the preamble hereof.
- "Aspen Aerogels Rhode Island" is Aspen Aerogels Rhode Island LLC, a Rhode Island limited liability company and wholly owned Subsidiary of Borrower.
- "Authorized Signer" is any individual listed in Borrower's Borrowing Resolution who is authorized to execute the Loan Documents, including making (and executing if applicable) any Credit Extension request, on behalf of Borrower.
- "Availability Amount" is (a) the lesser of (i) the Revolving Line or (ii) the amount available under the Borrowing Base minus (b) the Dollar Equivalent amount of all outstanding Letters of Credit (including drawn but unreimbursed Letters of Credit plus an amount equal to the Letter of Credit Reserve), minus (c) the FX Reduction Amount, minus (d) any amounts used for Cash Management Services, and minus (e) the outstanding principal balance of any Advances. The aggregate amount of all Advances (including, without limitation, the Dollar Equivalent amount of all outstanding Letters of Credit (including drawn but unreimbursed Letters of Credit plus an amount equal to the Letter of Credit Reserve), any outstanding FX Reduction Amount and any amounts used for Cash Management Services) under this Agreement outstanding at any time shall not exceed Twenty Million Dollars (\$20,000,000).
 - "Bank" is defined in the preamble hereof.
 - "Bank Entities" is defined in Section 12.9.
- "Bank Expenses" are all audit fees and expenses, costs, and expenses (including reasonable attorneys' fees and expenses) for preparing, amending, negotiating, administering, defending and enforcing the Loan Documents (including, without limitation, those incurred in connection with appeals or Insolvency Proceedings) or otherwise incurred with respect to Borrower or any Guarantor.
- "Bank Services" are any products, credit services, and/or financial accommodations previously, now, or hereafter provided to Borrower or any of its Subsidiaries by Bank or any Bank Affiliate, including, without limitation, any letters of credit, cash management services (including, without limitation, merchant services, direct

deposit of payroll, business credit cards, and check cashing services), interest rate swap arrangements, and foreign exchange services as any such products or services may be identified in Bank's various agreements related thereto (each, a "Bank Services Agreement").

"BASF" means BASF SE, a company organized under the laws of Germany, its affiliates, assignees or designees.

"BASF Receivables" means Accounts owing from BASF to Borrower from sales pursuant to the Supply Agreement which constitute Eligible Foreign Accounts.

"Borrower" is defined in the preamble hereof.

"Borrower's Books" are all Borrower's books and records including ledgers, federal and state tax returns, records regarding Borrower's assets or liabilities, the Collateral, business operations or financial condition, and all computer programs or storage or any equipment containing such information.

"Borrowing Base" is (a) eighty percent (80%) of Eligible Accounts, plus (b) eighty percent (80%) of Eligible Foreign Accounts (provided, however, Eligible Foreign Accounts that are billed in a Foreign Currency shall have an advance rate of seventy percent (70%); provided, further, that to the extent Eligible Foreign Accounts include BASF Receivables, such calculation shall be net of any credits Borrower is required to provide to BASF in connection with the BASF Receivables due to each Pre-Payment pursuant to the Supply Agreement; and provided, further, that to the extent Eligible Foreign Accounts include PTT LNG Receivables, such calculation shall be net of any credits Borrower is required to provide to Saipem S.A., CTCI Corporation, and/or SPCC Joint Venture in connection with the PTT LNG Receivables due to each prepayment pursuant to the PTT LNG Supply Agreement), provided, that, the availability under this subsection (b) plus the availability under subsection (c) below shall not exceed seventy-five percent (75%) of the Borrowing Base, plus (c) (i) when a Streamline Period is not in effect, the lesser of eighty percent (80%) of Eligible Specified Accounts or One Million Dollars (\$1,000,000) and (ii) during a Streamline Period, eighty percent (80%) of Eligible Specified Accounts (and with respect to subsections (c)(i) and (c)(ii) hereof, when added to the availability under subsection (b) above, in each case subject to the overall cap set forth in subsection (b) above), as determined by Bank from Borrower's most recent Borrowing Base Report (and as may subsequently be updated by Bank in Bank's sole discretion based upon information received by Bank including, without limitation, Accounts that are paid and/or billed following the date of the Borrowing Base Report); provided, however, that Bank may decrease the foregoing amounts and percentages in its good faith business judgment based on events, conditions, contingencies, or risks which, as determined by Bank, may adversely affect the Collateral.

"Borrowing Base Report" is that certain report of the value of certain Collateral in the form specified by Bank to Borrower from time to time.

"Borrowing Resolutions" are, with respect to any Person, those resolutions adopted by such Person's Board of Directors or other appropriate body and delivered by such Person to Bank approving the Loan Documents to which such Person is a party and the transactions contemplated thereby, together with a certificate executed by its secretary on behalf of such Person certifying that (a) such Person has the authority to execute, deliver, and perform its obligations under each of the Loan Documents to which it is a party, (b) attached as Exhibit A to such certificate is a true, correct, and complete copy of the resolutions then in full force and effect authorizing and ratifying the execution, delivery, and performance by such Person of the Loan Documents to which it is a party, (c) the name(s) of the Person(s) authorized to execute the Loan Documents, including making (and executing if applicable) any Credit Extension request, on behalf of such Person, together with a sample of the true signature(s) of such Person(s), and (d) Bank may conclusively rely on such certificate unless and until such Person shall have delivered to Bank a further certificate canceling or amending such prior certificate.

"Business Day" is any day that is not a Saturday, Sunday or other day on which banking institutions in the State of California or the Commonwealth of Massachusetts are authorized or required by law or other governmental action to close, except that if any determination of a "Business Day" shall relate to an FX Contract, the term "Business Day" shall mean a day on which dealings are carried on in the country of settlement of the Foreign Currency.

"Cash Collateral Account" is defined in Section 6.3(c).

"Cash Equivalents" means (a) marketable direct obligations issued or unconditionally guaranteed by the United States or any agency or any State thereof having maturities of not more than one (1) year after its creation and having the highest rating from either Standard & Poor's Ratings Group or Moody's Investors Service, Inc.; (c) Bank's certificates of deposit issued maturing no more than one (1) year after issue; and (d) money market funds at least ninety-five percent (95%) of the assets of which constitute Cash Equivalents of the kinds described in clauses (a) through (c) of this definition.

"Cash Management Services" is defined in Section 2.2.4.

"Claims" is defined in Section 12.3.

"Code" is the Uniform Commercial Code, as the same may, from time to time, be enacted and in effect in the Commonwealth of Massachusetts; provided, that, to the extent that the Code is used to define any term herein or in any Loan Document and such term is defined differently in different Articles or Divisions of the Code, the definition of such term contained in Article or Division 9 shall govern; provided further, that in the event that, by reason of mandatory provisions of law, any or all of the attachment, perfection, or priority of, or remedies with respect to, Bank's Lien on any Collateral is governed by the Uniform Commercial Code in effect in a jurisdiction other than the Commonwealth of Massachusetts, the term "Code" shall mean the Uniform Commercial Code as enacted and in effect in such other jurisdiction solely for purposes of the provisions thereof relating to such attachment, perfection, priority, or remedies and for purposes of definitions relating to such provisions.

"Collateral" is any and all properties, rights and assets of Borrower described on Exhibit A.

"Collateral Account" is any Deposit Account, Securities Account, or Commodity Account. Notwithstanding anything set forth herein to the contrary, "Collateral Account" shall not include any Excluded Deposit Account.

"Commodity Account" is any "commodity account" as defined in the Code with such additions to such term as may hereafter be made.

"Compliance Certificate" is that certain certificate in the form attached hereto as Exhibit B.

"Contingent Obligation" is, for any Person, any direct or indirect liability, contingent or not, of that Person for (a) any indebtedness, lease, dividend, letter of credit or other obligation of another such as an obligation, in each case, directly or indirectly guaranteed, endorsed, co-made, discounted or sold with recourse by that Person, or for which that Person is directly or indirectly liable; (b) any obligations for undrawn letters of credit for the account of that Person; and (c) all obligations from any interest rate, currency or commodity swap agreement, interest rate cap or collar agreement, or other agreement or arrangement designated to protect a Person against fluctuation in interest rates, currency exchange rates or commodity prices; but "Contingent Obligation" does not include endorsements in the ordinary course of business. The amount of a Contingent Obligation is the stated or determined amount of the primary obligation for which the Contingent Obligation is made or, if not determinable, the maximum reasonably anticipated liability for it determined by the Person in good faith; but the amount may not exceed the maximum of the obligations under any guarantee or other support arrangement.

"Control Agreement" is any control agreement entered into among the depository institution at which Borrower maintains a Deposit Account or the securities intermediary or commodity intermediary at which Borrower maintains a Securities Account or a Commodity Account, Borrower, and Bank pursuant to which Bank obtains control (within the meaning of the Code) over such Deposit Account, Securities Account, or Commodity Account.

"Copyrights" are any and all copyright rights, copyright applications, copyright registrations and like protections in each work of authorship and derivative work thereof, whether published or unpublished and whether or not the same also constitutes a trade secret.

- "Credit Extension" is any Advance, any Overadvance, Letter of Credit, FX Contract, amount utilized for Cash Management Services, or any other extension of credit by Bank for Borrower's benefit.
 - "Currency" is coined money and such other banknotes or other paper money as are authorized by law and circulate as a medium of exchange.
- "Current Liabilities" are all Obligations and liabilities of Borrower owed to Bank, plus, without duplication, the aggregate amount of Borrower's Total Liabilities that mature within one (1) year.
 - "Default" means any event which with notice or passage of time or both, would constitute an Event of Default.
 - "Default Rate" is defined in Section 2.4(e).
 - "Deferred Revenue" is all amounts received or invoiced in advance of performance under contracts and not yet recognized as revenue.
 - "Deposit Account" is any "deposit account" as defined in the Code with such additions to such term as may hereafter be made.
 - "Designated Deposit Account" is the multicurrency account denominated in Dollars, account number ending 8273, maintained by Borrower with Bank.
- "Division" means, in reference to any Person which is an entity, the division of such Person into two (2) or more separate Persons, with the dividing Person either continuing or terminating its existence as part of such division, including, without limitation, as contemplated under Section 18-217 of the Delaware Limited Liability Company Act for limited liability companies formed under Delaware law, or any analogous action taken pursuant to any other applicable law with respect to any corporation, limited liability company, partnership or other entity.
- "Dollars," "dollars" or use of the sign "\$" means only lawful money of the United States and not any other currency, regardless of whether that currency uses the "\$" sign to denote its currency or may be readily converted into lawful money of the United States.
- "Dollar Equivalent" is, at any time, (a) with respect to any amount denominated in Dollars, such amount, and (b) with respect to any amount denominated in a Foreign Currency, the equivalent amount therefor in Dollars as determined by Bank at such time on the basis of the then-prevailing rate of exchange in San Francisco, California, for sales of the Foreign Currency for transfer to the country issuing such Foreign Currency.
 - "Domestic Subsidiary" means a Subsidiary organized under the laws of the United States or any state or territory thereof or the District of Columbia.
- "EBITDA" shall mean (a) Net Income, plus (b) Interest Expense, plus (c) to the extent deducted in the calculation of Net Income, depreciation expense and amortization expense, plus (d) income tax expense, plus (e) non-cash stock compensation, plus (f) one-time non-recurring expenses approved by the Bank in its sole discretion.
 - "Effective Date" is defined in the preamble hereof.
- "Eligible Accounts" means Accounts which arise in the ordinary course of Borrower's business that meet all Borrower's representations and warranties in Section 5.3 and are due and owing from Account Debtors deemed creditworthy by Bank in its good faith business judgment. Bank reserves the right upon prior written notice to Borrower at any time after the Effective Date to adjust any of the criteria set forth below and to establish new criteria in its good faith business judgment. Unless Bank otherwise agrees in writing, Eligible Accounts shall not include:
 - (a) Accounts for which the Account Debtor is Borrower's Affiliate, officer, employee, or agent;

- (b) Accounts that the Account Debtor has not paid within ninety (90) days of invoice date regardless of invoice payment period terms;
 - (c) Accounts with credit balances over ninety (90) days from invoice date;
- (d) Accounts owing from an Account Debtor, in which fifty percent (50%) or more of the Accounts have not been paid within ninety (90) days of invoice date;
 - (e) Accounts owing from an Account Debtor which does not have its principal place of business in the United States or Canada;
 - (f) Accounts billed and/or payable outside of the United States (sometimes called foreign invoiced accounts);
- (g) Accounts owing from an Account Debtor to the extent that Borrower is indebted or obligated in any manner to the Account Debtor (as creditor, lessor, supplier or otherwise sometimes called "contra" accounts, accounts payable, customer deposits or credit accounts);
- (h) Accounts owing from an Account Debtor which is a United States government entity or any department, agency, or instrumentality thereof unless Borrower has assigned its payment rights to Bank and the assignment has been acknowledged under the Federal Assignment of Claims Act of 1940, as amended;
- (i) Accounts for demonstration or promotional equipment, or in which goods are consigned, or sold on a "sale guaranteed", "sale or return", "sale on approval", or other terms if Account Debtor's payment may be conditional;
- (j) Accounts owing from an Account Debtor where goods or services have not yet been rendered to the Account Debtor (sometimes called memo billings or pre-billings);
- (k) Accounts subject to contractual arrangements between Borrower and an Account Debtor (other than Subsea 7, Technip, EMAS, HMC, Saipem, McDermott, Worley Parsons, MCS Kenny and any of their affiliates, for which this clause (k) shall not be applicable), where payments shall be scheduled or due according to completion or fulfillment requirements where the Account Debtor has a right of offset for damages suffered as a result of Borrower's failure to perform in accordance with the contract (sometimes called contracts accounts receivable, progress billings, milestone billings, or fulfillment contracts);
- (l) Accounts owing from an Account Debtor the amount of which may be subject to withholding based on the Account Debtor's satisfaction of Borrower's complete performance (but only to the extent of the amount withheld; sometimes called retainage billings);
 - (m) Accounts subject to trust provisions subrogation rights of a bonding company, or a statutory trust;
- (n) Accounts owing from an Account Debtor that has been invoiced for goods that have not been shipped to the Account Debtor unless Bank, Borrower, and the Account Debtor have entered into an agreement acceptable to Bank in its sole discretion wherein the Account Debtor acknowledges that (i) it has title to and has ownership of the goods wherever located, (ii) a bona fide sale of the goods has occurred, and (iii) it owes payment for such goods in accordance with invoices from Borrower (sometimes called "bill and hold" accounts);
 - (o) Accounts for which the Account Debtor has not been invoiced;
 - (p) Accounts that represent non-trade receivables or that are derived by means other than in the ordinary course of Borrower's business;

- (q) Accounts for which Borrower has permitted Account Debtor's payment to extend beyond ninety (90) days;
- (r) Accounts arising from chargebacks, debit memos or other payment deductions taken by an Account Debtor;
- (s) Accounts arising from product returns and/or exchanges (sometimes called "warranty" or "RMA" accounts);
- (t) Accounts in which the Account Debtor disputes liability or makes any claim (but only up to the disputed or claimed amount), or if the Account Debtor is subject to an Insolvency Proceeding, or becomes insolvent, or goes out of business;
- (u) Accounts owing from an Account Debtor with respect to which Borrower has received Deferred Revenue (but only to the extent of such Deferred Revenue);
- (v) Accounts owing from an Account Debtor, whose total obligations to Borrower exceed thirty percent (30%) of all Accounts, for the amounts that exceed that percentage, unless Bank approves in writing;
- (w) Accounts for which Bank in its good faith business judgment determines collection to be doubtful, including, without limitation, accounts represented by "refreshed" or "recycled" invoices; and
 - (x) other Accounts Bank deems ineligible in the exercise of its good faith business judgment.
- "Eligible Foreign Accounts" are Accounts billed and collected by Borrower in the United States for which the Account Debtor is located in a country listed on Schedule I attached hereto, and such other countries approved by Bank in writing in its sole discretion on a case-by-case basis, that otherwise satisfy all criteria of Eligible Accounts (other than clause (e) in the definition thereof).
- "Eligible Specified Accounts" are Accounts billed and collected by Borrower in the United States for which the Account Debtor is specified in that certain side letter agreement between Bank and Borrower dated as of September 3, 2014, that otherwise satisfy all criteria of Eligible Accounts (other than clause (e) in the definition thereof).
- "Equipment" is all "equipment" as defined in the Code with such additions to such term as may hereafter be made, and includes without limitation all machinery, fixtures, goods, vehicles (including motor vehicles and trailers), and any interest in any of the foregoing.
 - "ERISA" is the Employee Retirement Income Security Act of 1974, and its regulations.
 - "Event of Default" is defined in Section 8.
 - "Exchange Act" is the Securities Exchange Act of 1934, as amended.
- "Excluded Deposit Account" means any Deposit Account exclusively used for payroll, payroll taxes and/or other employee wage and benefit payments to or for the benefit of Borrower's or any Guarantor's employees and identified to Bank by Borrower as such.
- "Excluded Intellectual Property" means (i) any "intent-to-use" application for registration of a Trademark filed pursuant to Section 1(b) of the Lanham Act, 15 U.S.C. §1051, prior to the filing of a "Statement of Use" pursuant to Section 1(d) of the Lanham Act or an "Amendment to Allege Use" pursuant to Section 1(c) of the Lanham Act with respect thereto, solely to the extent that, and for so long as, the grant of a security interest or lien therein would impair the validity or enforceability of any registration that issues from such "intent-to-use" application under applicable federal law and (ii) any rights under any license of Intellectual Property if the grant of a

security interest therein would be prohibited by the terms of such license, unless (x) the only consequence of breach of such terms would be to avoid or permit any other party to such license to avoid such security interest; or (y) such prohibition is rendered ineffective pursuant to the Uniform Commercial Code or any other applicable law.

- "Foreign Currency" means lawful money of a country other than the United States.
- "Foreign Subsidiary" means any direct or indirect Subsidiary of Borrower that is not a Domestic Subsidiary.
- "Funding Date" is any date on which a Credit Extension is made to or for the account of Borrower which shall be a Business Day.
- "FX Business Day" is any day when (a) Bank's Foreign Exchange Department is conducting its normal business and (b) the Foreign Currency being purchased or sold by Borrower is available to Bank from the entity from which Bank shall buy or sell such Foreign Currency.
 - "FX Contract" is defined in Section 2.2.3.
 - "FX Reduction Amount" is defined in Section 2.2.3.
- "GAAP" is generally accepted accounting principles set forth in the opinions and pronouncements of the Accounting Principles Board of the American Institute of Certified Public Accountants and statements and pronouncements of the Financial Accounting Standards Board or in such other statements by such other Person as may be approved by a significant segment of the accounting profession, which are applicable to the circumstances as of the date of determination.
- "General Intangibles" is all "general intangibles" as defined in the Code in effect on the date hereof with such additions to such term as may hereafter be made, and includes without limitation, claims, income and other tax refunds, security and other deposits, payment intangibles, contract rights, options to purchase or sell real or personal property, rights in all litigation presently or hereafter pending (whether in contract, tort or otherwise), insurance policies (including without limitation key man, property damage, and business interruption insurance), payments of insurance and rights to payment of any kind. Notwithstanding the foregoing, General Intangibles does not include Intellectual Property.
- "Governmental Approval" is any consent, authorization, approval, order, license, franchise, permit, certificate, accreditation, registration, filing or notice, of, issued by, from or to, or other act by or in respect of, any Governmental Authority.
- "Governmental Authority" is any nation or government, any state or other political subdivision thereof, any agency, authority, instrumentality, regulatory body, court, central bank or other entity exercising executive, legislative, judicial, taxing, regulatory or administrative functions of or pertaining to government, any securities exchange and any self-regulatory organization.
 - "Guarantor" is any present or future guarantor of the Obligations, including, without limitation, Aspen Aerogels Rhode Island.
- "Guarantor Security Agreement" is the Amended and Restated Security Agreement of Aspen Aerogels Rhode Island in favor of Bank dated as of September 3, 2014, as amended from time to time.
- "Guaranty" is any guarantee of all or any part of the Obligations, including, without limitation, the Amended and Restated Unconditional Guaranty of Aspen Aerogels Rhode Island in favor of Bank dated as of September 3, 2014, as the same may from time to time be amended, restated, modified or otherwise supplemented.
- "Indebtedness" is (a) indebtedness for borrowed money or the deferred price of property or services, such as reimbursement and other obligations for surety bonds and letters of credit, (b) obligations evidenced by notes,

bonds, debentures or similar instruments, (c) capital lease obligations (determined in accordance with GAAP), and (d) Contingent Obligations.

"Indemnified Person" is defined in Section 12.3.

"Insolvency Proceeding" is any proceeding by or against any Person under the United States Bankruptcy Code, or any other bankruptcy or insolvency law, including assignments for the benefit of creditors, compositions, extensions generally with its creditors, or proceedings seeking reorganization, arrangement, or other relief.

"Intellectual Property" means, with respect to any Person, means all of such Person's right, title, and interest in and to the following:

(a)its Copyrights, Trademarks and Patents;

(b)any and all trade secrets and trade secret rights, including, without limitation, any rights to unpatented inventions, know-how and operating manuals;

(c)any and all source code;

(d)any and all design rights which may be available to such Person;

(e)any and all claims for damages by way of past, present and future infringement of any of the foregoing, with the right, but not the obligation, to sue for and collect such damages for said use or infringement of the Intellectual Property rights identified above; and

(f)all amendments, renewals and extensions of any of the Copyrights, Trademarks or Patents.

"Interest Expense" means for any fiscal period, interest expense (whether cash or non-cash) determined in accordance with GAAP for the relevant period ending on such date, including, in any event, interest expense with respect to any Credit Extension and other Indebtedness of Borrower and its Subsidiaries, including, without limitation or duplication, all commissions, discounts, or related amortization and other fees and charges with respect to letters of credit and bankers' acceptance financing and the net costs associated with interest rate swap, cap, and similar arrangements, and the interest portion of any deferred payment obligation (including leases of all types).

"Interest Payment Date" means the first day of each month (or, if that day of the month does not fall on a Business Day, then on the first Business Day following such date).

"Inventory" is all "inventory" as defined in the Code in effect on the date hereof with such additions to such term as may hereafter be made, and includes without limitation all merchandise, raw materials, parts, supplies, packing and shipping materials, work in process and finished products, including without limitation such inventory as is temporarily out of Borrower's custody or possession or in transit and including any returned goods and any documents of title representing any of the above.

"Investment" is any beneficial ownership interest in any Person (including stock, partnership interest or other securities), and any loan, advance or capital contribution to any Person.

"Key Person" is each of Borrower's Chief Executive Officer and President as of the Effective Date, who is Donald R. Young, and Chief Financial Officer as of the Effective Date, who is John F. Fairbanks.

"Letter of Credit" is a standby letter of credit issued by Bank or another institution based upon an application, guarantee, indemnity or similar agreement on the part of Bank as set forth in Section 2.2.2.

"Letter of Credit Application" is defined in Section 2.2.2(b).

"Letter of Credit Reserve" has the meaning set forth in Section 2.2.2(e).

"Lien" is a claim, mortgage, deed of trust, levy, charge, pledge, security interest or other encumbrance of any kind, whether voluntarily incurred or arising by operation of law or otherwise against any property.

"Loan Documents" are, collectively, this Agreement and any schedules, exhibits, certificates, notices, and any other documents related to this Agreement, the Guaranty, the Guarantor Security Agreement, the Stock Pledge Agreement, any Bank Services Agreement, any subordination agreement, any note, or notes or guaranties executed by Borrower or any Guarantor, and any other present or future agreement between Borrower and/or any Guarantor and/or for the benefit of Bank in connection with this Agreement or Bank Services, all as amended, restated, or otherwise modified.

"Material Adverse Change" is (a) a material impairment in the perfection or priority of Bank's Lien in the Collateral or in the value of such Collateral; (b) a material adverse change in the business, operations, or financial condition of Borrower and its Subsidiaries, taken as a whole; or (c) a material impairment of the prospect of repayment of any portion of the Obligations.

"Material Contract" means any contract or agreement which, individually or in the aggregate, the termination of which could reasonably be expected to result in a Material Adverse Change.

"Material Indebtedness" means Indebtedness of the Borrower or its Subsidiaries in a principal amount in excess of \$250,000.

"Minimum Eligibility Requirements" is defined in the definition of Eligible Accounts.

"Monthly Financial Statements" is defined in Section 6.2(c).

"Net Income" means, as calculated on a consolidated basis for Borrower and its Subsidiaries for any period as at any date of determination, the net profit (or loss), after provision for taxes, of Borrower and its Subsidiaries for such period taken as a single accounting period.

"Obligations" are Borrower's obligations to pay when due any debts, principal, interest, fees, Bank Expenses, and other amounts Borrower owes Bank now or later, whether under this Agreement, the other Loan Documents, or otherwise, including, without limitation, all obligations relating to Letters of Credit (including reimbursement obligations for drawn and undrawn Letters of Credit), cash management services, and foreign exchange contracts, if any, and including interest accruing after Insolvency Proceedings begin and debts, liabilities, or obligations of Borrower assigned to Bank, and to perform Borrower's duties under the Loan Documents.

"Operating Documents" are, for any Person, such Person's formation documents, as certified by the Secretary of State of such Person's state of formation on a date that is no earlier than thirty (30) days prior to the Effective Date, and, (a) if such Person is a corporation, its bylaws in current form, (b) if such Person is a limited liability company, its limited liability company agreement (or similar agreement), and (c) if such Person is a partnership, its partnership agreement (or similar agreement), each of the foregoing with all current amendments or modifications thereto.

"Overadvance" is defined in Section 2.3.

"Patents" means all patents, patent applications and like protections including without limitation improvements, divisions, continuations, renewals, reissues, extensions and continuations-in-part of the same.

"Perfection Certificate" is defined in Section 5.1.

"Permitted Indebtedness" is:

(a)Borrower's Indebtedness to Bank under this Agreement and the other Loan Documents;

- (b)Indebtedness existing on the Effective Date and shown on the Perfection Certificate;
- (c)Subordinated Debt;
- (d)unsecured Indebtedness to trade creditors incurred in the ordinary course of business;
- (e)Indebtedness secured by Liens permitted under clauses (a) and (c) of the definition of "Permitted Liens" hereunder;

(f)Indebtedness (i) of Subsidiaries owed to Borrower for any Subsidiary that has executed a Security Agreement in favor of the Bank and (ii) Subsidiaries owed to Borrower, in an aggregate amount, together with Investments permitted in connection with clause (d) of the definition of "Permitted Investments", not to exceed Two Hundred Fifty Thousand Dollars (\$250,000) in any fiscal year; and

(g)extensions, refinancings, modifications, amendments and restatements of any items of Permitted Indebtedness (a) through (e) above, provided that the principal amount thereof is not increased or the terms thereof are not modified to impose more burdensome terms upon Borrower or its Subsidiary, as the case may be.

"Permitted Investments" are:

- (a) Investments shown on the Perfection Certificate and existing on the Effective Date;
- (b) Cash Equivalents:
- (c) Investments consisting of the endorsement of negotiable instruments for deposit or collection or similar transactions in the ordinary course of Borrower's business:
- (d) Investments (i) by Borrower in any Subsidiary that has executed a Security Agreement in favor of Bank and (ii) by Borrower in any Subsidiary, in an aggregate amount, together with any Indebtedness described in clause (f) of the definition of "Permitted Indebtedness", not to exceed Two Hundred Fifty Thousand Dollars (\$250,000) in any fiscal year;
- (e) Investments (including debt obligations) received in connection with the bankruptcy or reorganization of customers or suppliers and in settlement of delinquent obligations of, and other disputes with, customers or suppliers arising in the ordinary course of business; and
- (f) Investments consisting of notes receivable of, or prepaid royalties and other credit extensions, to customers and suppliers who are not Affiliates, in the ordinary course of business; provided that this paragraph (f) shall not apply to Investments of Borrower in any Subsidiary.

"Permitted Liens" are:

- (1) Liens existing on the Effective Date and shown on the Perfection Certificate or arising under this Agreement and the other Loan Documents;
- (2) Liens for taxes, fees, assessments or other government charges or levies, either (i) not due and payable or (ii) being contested in good faith and for which Borrower maintains adequate reserves on its Books, provided that no notice of any such Lien has been filed or recorded under the Internal Revenue Code of 1986, as amended, and the Treasury Regulations adopted thereunder;
- (3) purchase money Liens (i) on Equipment acquired or held by Borrower incurred for financing the acquisition of the Equipment securing no more than Five Hundred Thousand Dollars (\$500,000) in the aggregate amount outstanding, or (ii) existing on Equipment when acquired, if the Lien is confined to the property and improvements and the proceeds of the Equipment;

- (4) Liens to secure payment of workers' compensation, employment insurance, old-age pensions, social security and other like obligations incurred in the ordinary course of business (other than Liens imposed by ERISA);
- (5) Liens incurred in the extension, renewal or refinancing of the Indebtedness secured by Liens described in (a) through (c), but any extension, renewal or replacement Lien must be limited to the property encumbered by the existing Lien and the principal amount of the indebtedness may not increase;
- leases or subleases of real property granted in the ordinary course of Borrower's business, and leases, subleases, non-exclusive licenses or sublicenses of property (other than real property or Intellectual Property) granted in the ordinary course of Borrower's business, <u>if</u> the leases, subleases, licenses and sublicenses do not prohibit granting Bank a security interest;
- (7) non-exclusive license of material Intellectual Property granted to third parties in the ordinary course of business, and licenses of material Intellectual Property that could not result in a legal transfer of title of the licensed property that may be exclusive in respects other than territory and that may be exclusive as to territory only as to discreet geographical areas outside of the United States and any licenses of Intellectual Property which do not constitute material Intellectual Property;
 - (8) Liens securing Permitted Indebtedness; and
- (9) Liens arising from judgments, decrees or attachments in circumstances not constituting an Event of Default under Section 8.4 or 8.7.

"Person" is any individual, sole proprietorship, partnership, limited liability company, joint venture, company, trust, unincorporated organization, association, corporation, institution, public benefit corporation, firm, joint stock company, estate, entity or government agency.

"PPP Forgivable Amount" is the amount of the PPP Loan that is eligible to be forgiven in accordance with the Paycheck Protection Program under the Coronavirus Aid, Relief, and Economic Security Act of 2020, so long as no Governmental Authority, the PPP Lender, or any Person acting for or on behalf of the PPP Lender has determined that such amount is not eligible to be forgiven or denied an application for such forgiveness of such amount.

"PPP Lender" means Loan Source, Inc.

"PPP Loan" means the unsecured loan to Borrower by the PPP Lender in the original principal amount of \$3,685,800 as set forth in the Perfection Certificate as of the Effective Date pursuant to the Paycheck Protection Program under the Coronavirus Aid, Relief, and Economic Security Act of 2020.

"Prime Rate" is the rate of interest per annum from time to time published in the money rates section of The Wall Street Journal or any successor publication thereto as the "prime rate" then in effect; provided that, in the event such rate of interest is less than zero, such rate shall be deemed to be zero for purposes of this Agreement; and provided further that if such rate of interest, as set forth from time to time in the money rates section of The Wall Street Journal, becomes unavailable for any reason as determined by Bank, the "Prime Rate" shall mean the rate of interest per annum announced by Bank as its prime rate in effect at its principal office in the State of California (such Bank announced Prime Rate not being intended to be the lowest rate of interest charged by Bank in connection with extensions of credit to debtors); provided that, in the event such rate of interest is less than zero, such rate shall be deemed to be zero for purposes of this Agreement.

"Prime Rate Margin" is the rate per annum set forth under the relevant column heading below:

Borrowing Base Component	Prime Rate Margin during a Streamline Period	<u>Prime Rate Margin when a</u> <u>Streamline Period is not in effect</u>
Eligible Accounts	0.75%	1.50%
Eligible Foreign Accounts	1.25%	2.00%

"Prior Loan Agreement" is defined in the preamble hereof.

"PTT LNG" means PTT LNG Company Limited, a company organized under the laws of Thailand, its affiliates, assignees or designees.

"PTT LNG Receivables" means Accounts owing from Saipem S.A., CTCI Corporation, and/or SPCC Joint Venture to Borrower from sales pursuant to the PTT LNG Supply Agreement which constitute Eligible Foreign Accounts.

"PTT LNG Supply Agreement" means that certain purchase order dated March 11, 2019 and accepted April 11, 2019 by and between Borrower and Saipem S.A. and CTCI Corporation collectively as SPCC Joint Venture for supply of products for use in an LNG Terminal project of PTT LNG, as amended, modified, supplemented or restated from time to time.

"Quick Assets" is, on any date, Borrower's unrestricted cash maintained with Bank plus accounts receivable net of allowance for doubtful accounts.

"Registered Organization" is any "registered organization" as defined in the Code with such additions to such term as may hereafter be made.

"Regulatory Change" means, with respect to Bank, any change on or after the date of this Agreement in United States federal, state, or foreign laws or regulations, including Regulation D, or the adoption or making on or after such date of any interpretations, directives, or requests applying to a class of lenders including Bank, of or under any United States federal or state, or any foreign laws or regulations (whether or not having the force of law) by any court or governmental or monetary authority charged with the interpretation or administration thereof.

"Requirement of Law" is as to any Person, the organizational or governing documents of such Person, and any law (statutory or common), treaty, rule or regulation or determination of an arbitrator or a court or other Governmental Authority, in each case applicable to or binding upon such Person or any of its property or to which such Person or any of its property is subject.

"Reserves" means, as of any date of determination, such amounts as Bank may from time to time establish and revise in good faith reducing the amount of Advances, Letters of Credit and other financial accommodations which would otherwise be available to Borrower under the lending formulas: (a) to reflect events, conditions, contingencies or risks which, as determined by Bank in good faith, do or may affect (i) the Collateral or any other property which is security for the Obligations or its value (including without limitation any increase in delinquencies of Accounts), (ii) the assets, business of Borrower or any Guarantor, or (iii) the security interests and other rights of Bank in the Collateral (including the enforceability, perfection and priority thereof); or (b) to reflect Bank's good faith belief that any collateral report or financial information furnished by or on behalf of Borrower or any Guarantor to Bank is or may have been incomplete, inaccurate or misleading in any material respect; or (c) in respect of any state of facts which Bank determines in good faith constitutes an Event of Default or may, with notice or passage of time or both, constitute an Event of Default.

"Responsible Officer" is any of the Chief Executive Officer, President, Chief Financial Officer, Vice President (Finance) and Controller of Borrower.

"Restricted License" is any license or other agreement, the absence of which would be reasonably expected to cause a material adverse effect on Borrower's business, with respect to which Borrower is the licensee (a) that prohibits or otherwise restricts Borrower from granting a security interest in Borrower's interest in such license or agreement or any other property, or (b) for which a default under or termination of could interfere with the Bank's right to sell any Collateral.

"Revolving Line" is an aggregate principal amount not to exceed Twenty Million Dollars (\$20,000,000) outstanding at any time.

"Revolving Line Maturity Date" is April 28, 2022.

"SEC" shall mean the Securities and Exchange Commission, any successor thereto, and any analogous Governmental Authority.

"Securities Account" is any "securities account" as defined in the Code with such additions to such term as may hereafter be made.

"Security Agreement" is any present or future security agreement pursuant to which any Person pledges its Collateral to Bank as security for the Obligations, including, without limitation, the Guarantor Security Agreement.

"Settlement Date" is defined in Section 2.2.3.

"Stock Pledge Agreement" is that certain Stock Pledge Agreement, dated as of March 31, 2011, executed by Borrower in favor of Bank, as amended from time to time.

"Streamline Period" is, on and after the Effective Date, provided no Event of Default has occurred and is continuing, the period (a) commencing on the first day of the month following the day that Borrower provides to Bank a written report that Borrower has, for each consecutive day in the immediately preceding month, maintained an Adjusted Quick Ratio of at least 1.50 to 1.00, as determined by Bank in its reasonable discretion (the "Streamline Threshold"); and (b) terminating on the earlier to occur of (i) the occurrence of an Event of Default, and (ii) the first day thereafter in which Borrower fails to maintain the Streamline Threshold, as determined by Bank in its reasonable discretion. Upon the termination of a Streamline Period, Borrower must maintain the Streamline Threshold each consecutive day for one (1) month, as determined by Bank in its reasonable discretion, prior to entering into a subsequent Streamline Period. Borrower shall give Bank prior written notice of Borrower's election to enter into any such Streamline Period, and each such Streamline Period shall commence on the first day of the monthly period following the date the Bank determines, in its reasonable discretion, that the Streamline Threshold has been achieved; provided that, notwithstanding the foregoing, a Streamline Period is in effect on the Effective Date.

"Subordinated Debt" is indebtedness incurred by Borrower subordinated to all of Borrower's now or hereafter indebtedness to Bank (pursuant to a subordination, intercreditor, or other similar agreement in form and substance satisfactory to Bank entered into between Bank and the other creditor), on terms acceptable to Bank.

"Subsidiary" is, as to any Person, a corporation, partnership, limited liability company or other entity of which shares of stock or other ownership interests having ordinary voting power (other than stock or such other ownership interests having such power only by reason of the happening of a contingency) to elect a majority of the board of directors or other managers of such corporation, partnership or other entity are at the time owned, or the management of which is otherwise controlled, directly or indirectly through one or more intermediaries, or both, by such Person. Unless the context otherwise requires, each reference to a Subsidiary herein shall be a reference to a Subsidiary of Borrower or Guarantor.

"Supply Agreement" means that certain Amended and Restated Supply Agreement dated as of February 16, 2018 by and between Borrower and BASF, as amended by the First Addendum to the Amended and Restated Supply Agreement.

"Total Liabilities" is on any day, all obligations that should, under GAAP, be classified as liabilities on Borrower's consolidated balance sheet, including all Indebtedness, but excluding all Subordinated Debt.

"**Trademarks**" means any trademark and servicemark rights, whether registered or not, applications to register and registrations of the same and like protections, and the entire goodwill of the business of Borrower connected with and symbolized by such trademarks.

"Transfer" is defined in Section 7.1.

"Unused Revolving Line Facility Fee" is defined in Section 2.5(c).

[Signature page follows.]

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed as a sealed instrument under the laws of the Commonwealth of Massachusetts as of the Effective Date.

BORROWER

ASPEN AEROGELS, INC.

By: /s/ Donald Young

Name: Donald R. Young
Title: Chief Executive Officer

BANK

SILICON VALLEY BANK

By: /s/ Charles Bradford

Name: C.J. Bradford Title: Vice President

EXHIBIT A - COLLATERAL DESCRIPTION

The Collateral consists of all of Borrower's right, title and interest in and to the following personal property:

All goods, Accounts (including health-care receivables), Equipment, Inventory, contract rights or rights to payment of money, leases, license agreements, franchise agreements, General Intangibles (except as provided below), commercial tort claims, documents, instruments (including any promissory notes), chattel paper (whether tangible or electronic), cash, Collateral Accounts, fixtures, letters of credit rights (whether or not the letter of credit is evidenced by a writing), securities, and all other investment property, supporting obligations, and financial assets, whether now owned or hereafter acquired, wherever located; and

all Borrower's Books relating to the foregoing, and any and all claims, rights and interests in any of the above and all substitutions for, additions, attachments, accessories, accessions and improvements to and replacements, products, proceeds and insurance proceeds of any or all of the foregoing.

Notwithstanding the foregoing, the Collateral does not include (a) more than 65% of the presently existing and hereafter arising issued and outstanding shares of capital stock owned by Borrower of any Foreign Subsidiary which shares entitle the holder thereof to vote for directors or any other matter, (b) any Excluded Deposit Accounts, or (c) any Intellectual Property; provided, however, the Collateral shall include all Accounts and all proceeds of Intellectual Property. If a judicial authority (including a U.S. Bankruptcy Court) would hold that a security interest in the underlying Intellectual Property is necessary to have a security interest in such Accounts and such property that are proceeds of Intellectual Property, then the Collateral shall automatically, and effective as of the Effective Date, include the Intellectual Property to the extent necessary to permit perfection of Bank's security interest in such Accounts and such other property of Borrower that are proceeds of the Intellectual Property.

Pursuant to the terms of a certain negative pledge arrangement with Bank, Borrower has agreed not to encumber any of its Intellectual Property without Bank's prior written consent.

EXHIBIT B COMPLIANCE CERTIFICATE

TO: SILICON VALLEY BANKDate: FROM: ASPEN AEROGELS, INC.

The undersigned authorized officer of Aspen Aerogels, Inc. ("Borrower") certifies that under the terms and conditions of the Amended and Restated Loan and Security Agreement between Borrower and Bank (as amended and in effect, the "Agreement"), (1) Borrower is in complete compliance for the period ending ______ with all required covenants except as noted below, (2) there are no Events of Default, (3) all representations and warranties in the Agreement are true and correct in all material respects on this date except as noted below; provided, however, that such materiality qualifier shall not be applicable to any representations and warranties that already are qualified or modified by materiality in the text thereof; and provided, further that those representations and warranties expressly referring to a specific date shall be true, accurate and complete in all material respects as of such date, (4) Borrower, and each of its Subsidiaries, has timely filed all required tax returns and reports, and Borrower has timely paid all foreign, federal, state and local taxes, assessments, deposits and contributions owed by Borrower except as otherwise permitted pursuant to the terms of Section 5.9 of the Agreement, and (5) no Liens have been levied or claims made against Borrower or any of its Subsidiaries, if any, relating to unpaid employee payroll or benefits of which Borrower has not previously provided written notification to Bank. Attached are the required documents supporting the certification. The undersigned certifies that these are prepared in accordance with GAAP consistently applied from one period to the next except as explained in an accompanying letter or footnotes. The undersigned acknowledges that no borrowings may be requested at any time or date of determination that Borrower is not in compliance with any of the terms of the Agreement, and that compliance is determined not just at the date this certificate is delivered. Capitalized terms used but not otherwise defined herein shall have the meanings given

e indicate compliance status by circling Yes/No under "Complies" column.

Reporting Covenant	<u>Required</u>	Complies
nthly financial statements with	Monthly within 30 days	Yes No
npliance Certificate		
rterly financial statements with	Quarterly within 45 days	Yes No
npliance Certificate		
ual financial statement (CPA Audited)	FYE within 150 days	Yes No
Q, 10-K and 8-K	Within 5 days after filing with SEC	Yes No
& A/P Agings, and Deferred Revenue reports	Monthly within 20 days	Yes No
rowing Base Reports	15th and last Business Day of each month	Yes No
	(monthly within 20 days when a	
	Streamline Period	
	is in effect) and with each request for a	
	Credit Extension;	
ections	FYE within 30 days	Yes No

Financial Covenant	Required .	Actual	<u>Complies</u>
intain as indicated:			
imum EBITDA	*	\$	Yes No
imum Adjusted Quick Ratio	1.20 to 1.00	to 1.00	Yes No

^{*}See Section 6.9

Performance Pricing		<u>Applies</u>
usted Quick Ratio at least 1.50:1.00	Prime + 0.75% (Eligible Accounts) or Prime + 1.25%	Yes No
	(Eligible Foreign Accounts);	

usted Quick Ratio less than 1.50:1.00	Prime + 1.50% (Eligible Accounts); Prime + 2.00% (Eligible Foreign Accounts)	Yes No	
The following financial covenant analyses	and information set forth in Schedule 1 attached hereto are true	e and accurate as of t	the date of this Certificate.
The following are the exceptions with resp	ect to the certification above: (If no exceptions exist, state "No	exceptions to note.")
ASPEN AEROGELS, INC.	BANK USE ONL	Y	
By:	Received by:		_
Name:	AUTHORIZED SIGNER		
Title:	Date:		
	Verified:		_
	AUTHORIZED SIGNER		
	Date:		
	Compliance Status:	Yes No	

Schedule 1 to Compliance Certificate

Financial Covenants of Borrower

In the event of a conflict between this Schedule and the Loan Agreement, the terms of the Loan Agreement shall govern.

I. **EBITDA** (Section 6.9(a))

Required:

Borrower shall achieve, measured as of the end of each fiscal quarter during the following periods, EBITDA of at least (loss not worse than) the following for the following periods:

Period	Minimum EBITDA (maximum loss)
Trailing twelve (12) month period ending December 31, 2020	(\$7,000,000)
Trailing three (3) month period ending March 31, 2021	(\$4,500,000)
Trailing six (6) month period ending June 30, 2021	(\$7,500,000)
Trailing nine (9) month period ending September 30, 2021	(\$9,800,000)
Trailing twelve (12) month period ending December 31, 2021	(\$11,000,000)

For the quarterly periods ending after December 31, 2021, the minimum EBITDA financial covenant thresholds shall be determined by Bank in its sole discretion on or before February 28, 2022 based on the Board-approved projections delivered to Bank pursuant to Section 6.2(f) hereof; provided further, that failure to timely deliver such Board-approved projections in accordance with Section 6.2(f) shall result in an immediate Event of Default for which no cure or grace period shall apply.

Actual:

- A. Net Income
- B. To the extent included in the determination of Net Income
 - 1. The provision for income taxes
 - 2.Depreciation expense
 - 3. Amortization expense
 - 4.Net Interest Expense
 - 5. Non-cash stock compensation expense
 - 6. One-time non-recurring expenses approved by the Bank in its sole discretion
 - 7. The sum of lines 1 through 6
- C. EBITDA (line I.A plus line I.B.7)

Is line I.C equal to or greater than \$?				
No, not in compliance	Yes, in compliance			

II. Adjusted Quick Ratio (Section 6.9(b))

Required: Borrower shall maintain at all times, to be tested as of the last day of each month, an Adjusted Quick Ratio of at least 1.20 to 1.00.

Actual:

A.	Unrestricted cash maintained with Bank	\$
B.	Accounts receivable net of allowance for doubtful accounts	\$
C.	Quick Assets (line II.A. plus line II.B.)	\$
D.	All Obligations and liabilities of Borrower owed to Bank	\$
E.	Without duplication of line II.D., the aggregate amount of Borrower's Total Liabilities that mature within one (1) year	\$
F.	Current Liabilities (line II.D. plus line II.E.)	\$
G.	Current portion of Deferred Revenue	\$
H.	Current portion of the PPP Forgivable Amount	\$
I.	Current portion of any Pre-Payment Balance or any other prepayment amount under the Supply Agreement	\$
J.	Dollar Equivalent amount of all outstanding Letters of Credit	\$
K.	Amount of any Pre-Payment Balance or any other prepayment amount due to BASF following a BASF Request	\$
L.	Line II.F minus line II.G minus II.H minus line II.I minus line II.J plus line II.K	\$
M.	Adjusted Quick Ratio (line II.C divided by line II.L)	:1.00

Is line M equal to or greater than 1.20:1:00?

No, not in compliance

Yes, in compliance

$\underline{Schedule\ I}$

		K
1	Australia	
2	Austria	
3	Belgium	
4	Brazil	
5	Chile	
6	Czech Republic	
7	Denmark	
8	Dubai	
9	Finland	
10	France	
11.	Germany	
12.	Ireland	
13.	Israel	
14	Italy	
15	Japan	
16	Mexico	
17	Netherlands	
18	Norway	
19	Poland	
20	Qatar	
21	Singapore	
22	South Korea	
23	Spain	
24	Sweden	
25	Switzerland	
26	Taiwan	
27	Turkey	
28	United Arab Emirates (other than with the government of the UA	E)

29

United Kingdom

SUBSIDIARIES OF ASPEN AEROGELS, INC.

Aspen Aerogels Germany GmbH, a German entity

Aspen Aerogels Rhode Island, LLC, a Rhode Island limited liability company

Aspen Aerogels Georgia, LLC, a Georgia limited liability company

Consent of Independent Registered Public Accounting Firm

The Board of Directors Aspen Aerogels, Inc.:

We consent to the incorporation by reference in the registration statements (Nos. 333-227158 and 333-221403) on Form S-3, and registration statements (Nos. 333-236955, 333-230165, 333-223380, 333-216434, 333-209995 and 333-198124) on Form S-8 of Aspen Aerogels, Inc. of our report dated March 12, 2021, with respect to the consolidated balance sheets of Aspen Aerogels, Inc. and subsidiaries as of December 31, 2020 and 2019, the related consolidated statements of operations, stockholders' equity, and cash flows for each of the years in the three-year period ended December 31, 2020, and the related notes and financial statement schedule II – Valuation and Qualifying Accounts, and the effectiveness of internal control over financial reporting as of December 31, 2020, which report appears in the December 31, 2020 annual report on Form 10-K of Aspen Aerogels, Inc.

Our report refers to a change in accounting principles related to leases.

/s/ KPMG LLP

Hartford, Connecticut March 12, 2021

CERTIFICATIONS UNDER SECTION 302

I, Donald R. Young, certify that:

- 1. I have reviewed this annual report on Form 10-K of Aspen Aerogels, Inc.;
- 2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
- 3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
- 4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
- a) designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
- b) designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
- c) evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
- d) disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
- 5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
- a) all significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
- b) any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 12, 2021

/s/ Donald R. Young
Donald R. Young
President and Chief Executive Officer
(principal executive officer)

CERTIFICATIONS UNDER SECTION 302

I, John F. Fairbanks, certify that:

- 1. I have reviewed this annual report on Form 10-K of Aspen Aerogels, Inc.;
- 2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
- 3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
- 4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
- a) designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
- b) designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
- c) evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
- d) disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
- 5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
- a) all significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
- b) any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 12, 2021

/s/ John F. Fairbanks

John F. Fairbanks

Vice President, Chief Financial Officer and Treasurer (principal financial officer and principal accounting officer)

CERTIFICATIONS UNDER SECTION 906

Pursuant to section 906 of the Sarbanes-Oxley Act of 2002 (subsections (a) and (b) of section 1350, chapter 63 of title 18, United States Code), each of the undersigned officers of Aspen Aerogels, Inc., a Delaware corporation (the "Company"), does hereby certify, to such officer's knowledge, that:

The Annual Report for the year ended December 31, 2020 (the "Form 10-K") of the Company fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, and the information contained in the Form 10-K fairly presents, in all material respects, the financial condition and results of operations of the Company.

Dated: March 12, 2021 /s/ Donald R. Young

Donald R. Young

President and Chief Executive Officer

(principal executive officer)

Dated: March 12, 2021 /s/ John F. Fairbanks

John F. Fairbanks

Vice President, Chief Financial Officer and Treasurer (principal financial officer and principal accounting officer)