

## 2.4 Aerogel-Fiber Hybrid Laminate

**Statement:** A multifunctional hybrid laminate composite for harsh environments and high-performance applications.

**Problem addressed:** A new material is needed to meet both structural and thermal requirements with increased impact resistance.

**Solution:** The technology focuses on aerogel and fiber composites integrated into unique lay-ups with thermal and mechanical energy-absorption capabilities. This new lightweight laminate composite system has multi-functionality for both high- and low-temperature applications, depending on the fiber chosen.

**Technology description:** The novel laminate composite and its construction can utilize a wide range of epoxy resins. The panel laminate system can be tailored by varying fiber choice (polyester, carbon, Kevlar, Spectra, etc., and their combinations), aerogel panel type and thickness, and overall layup configuration. The combination of materials may be customized to achieve a range of desired properties in the resulting laminate system.

**Benefits of the product:** The new materials have a number of special properties, including:

- Insulative - tailoring the design of the composite architecture can provide a 25-75% reduction in heat transfer.
- Lightweight - the composite sandwich structure can offer substantial weight savings.
- Tailorable designs - enables customized combinations of properties in one architectural system.
- Acoustic energy dampening - provides enhanced sound attenuation properties.
- Mechanical energy absorbing - tailoring can be used to withstand heavy vibration loads and mechanical impacts.
- fire barrier properties - using aerogel in a sandwich lay-up structure provides increased fire barrier properties.

**Areas of application:** The new material has a few applications from cryogenic to high temperature environments:

- Roofing, decking, and other building materials.
- Thermal insulating panels.
- Transportation and storage containers.
- Hurricane shutters/structural panels.
- Automobile, and marine components.
- Sound and fire barriers.
- Personal protective gear.
- Cryogenic storage tanks.