Thermal Insulation Division

Nanotechnological Advanced Products
For extreme Thermal Protection

Materials developed from aerospace technology and for extreme temperatures Thermal insulating products for use in clothing & associated articles utilising

AEROGEL
Maximum comfort
Delta T°C  -76°C/+50°C.

Materials are environmentally friendly, natural, non polluting, resistant & long wearing
Great for outdoor sporting activities, camping and hunting

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AEROGEL INSULATION
Introducing NASA developed technology to the world of outdoors
2-8 times more effective than traditional insulation, especially in footwear

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What is Aerogel:

• Aerogel was developed and used by NASA and is a material which can now be used in our day to day life, from personal use to workplace safety, sport and outdoors.

• Aerogel is composed of 90% air and this makes it an extremely efficient insulator with the lowest thermal conductivity, normally found in solid materials.

• The compound developed from Aerogel, which is an innovative thermal insulator, allows us to insulate between 2-8 times better and more efficient than any other traditional material on the market today.

• The temperature ranges +50°C/-76°C
• will not absorb water yet is breathable
• is durably water repellent, even at high temperatures
• the hydrophobicity allows it to maintain thermal conductivity properties in wet conditions
• is super-hydrophobic, yet also... water vapor permeable

Water droplet with contact angle >150°

Insulates better than air
"Aerogel" has an extremely complex structure along with extreme physical properties. "Aerogel” has an extremely low thermal conductivity of 12-13 mW/mK at 37°C.

This brings to the best Clo value per unit thickness in comparison with other types of materials:
TEC10⁻⁹ Aerogel insulation is thin, compression-resistant and waterproof. The ideal choice for outdoor products, individual protective clothes and footwear insulation.

Brings space age technology into everyday life.

Advantages of TEC10⁻⁹ Aerogel over other types of thermal insulation:
• Highest thermal performance
• Minimum thickness allowing thinner design with superior thermal performance
• Loft not required to maintain R value
• Doesn’t compress or lose performance under load
• Durable in normal wash/dry cycle
Other insulation materials require loft to achieve their insulation value. Pressure causes these materials to compress dramatically and lose their loft along with their insulating capacity. Aerotherm does not need loft to deliver its high insulation value and it barely compresses, even in a foot bed under adult weight. At 15 psi pressure, aerogel insulation retains over 95% of its original thickness and over 97% of its original thermal performance. No other insulation can match this performance.
Thermal Insoles – “Space Sole”

Insulating materials derived from "Aerogel" – “Space Sole”

Our company has experience and expertise in finding unique & special solutions whilst providing value added technology and know-how to the market. Our approach leads to adding further value to our customer’s needs.
Thermal Insoles – “Space Sole”

- Minimum thickness of 2-3 mm or different thicknesses depending on the application requirement
- Flexible - Easily adaptable to the geometries required
- Resistance even in extreme conditions
- Hydrophobic and transpiration of water vapor

Since Aerogel does not require "loft" for maintaining its thermal insulation properties even with a thickness of 2 mm, the product provides sufficient thermal protection even in extreme temperatures. Other materials require loft to maintain their insulation properties. The pressure causes these materials to compress drastically losing their loft and, therefore, their insulating capacity. Aerogel does not need loft to ensure its high insulation value.

Aerogel compresses slightly, even in an arch under the weight of an adult. At a pressure of 15psi, the insulation holds more than 85% of its original thickness and more than 95% of its original thermal performance.
AEROGEL - Technical Characteristics & Advantages

• Includes nano-porous "Aerogel" which is the best thermal insulator in the world with record-low thermal conductivity

• **Superior thermal performance:** 2-8 times more effective than any other thermal insulation, no loft required

• **Reduced profile & thickness:** Extremely thin and flexible – with a thickness of 2-3 mm it can replace other materials with a thermal loft of 5-15 mm.

• **Physically robust:** Does not compress; it maintains heat resistance and performance under pressure & is the ideal choice for applications in footwear (midsole, board, insole, toe). Recovers its thermal performance even after being compressed up to 50 psi

• **Hydrophobic:** Repels liquid water. Subjected to water performance testing; tested in extreme climates and in extreme conditions (From the deserts of the United States to the snowy mountains and glaciers of Mont Blanc and Everest)

• Environmentally friendly and Landfill disposable with no inhalable fiber content
A wide range of products in Aerogel:
Products with Superior Thermal performance

Sport & Outdoor
• Shoes
• Clothing Inserts
• Gloves

Healthcare
• Thermal bags for transporting blood & organs
• Thermal Clothing suitable for operating theatres, laboratories & hospitals
• Thermal blankets

Other Products- made to measure
• Products to maintain heat & cold
• Thermal Gloves
• Foldable cushions suitable for outdoor events (Hot or Cold)
• Products made in accordance to your requirements and design
“Space Sole”

- The "Space Sole" insoles in Aerogel provide a thermal barrier and protection against severe weather conditions. Maximizes heat retention and reflection, trapping the body heat from escaping and blocking the cold and the heat from below the foot.

- **Insoles – various Options:**
  - Insoles – flat/ shaped/moulded/printed
  - Custom tailored – made to measure
  - EVA and PU, fabric on top. 2 mm or 3 mm of airgel insulation.
  - The thickness is 3-4 mm (flat), 5-6 mm (moulded).
  - Very thin (2.5 mm) with PU foam insole on top

- **Application:**
  - Footwear – including workboots - Workplace Safety (OH&S)
  - Motorbike boots
  - Sporting Footwear – Suitable for all sports
    - Running, Football, Cycling, Skiing, Trekking, Skiing etc;
  - Gloves

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• Ultra-Silica Aerogel holds numerous world records for it’s physical properties

1. Highest thermal insulating value,
2. Lowest density,
3. The highest specific surface area,
4. The lowest refractive index,
5. The lowest sound barrier
**Physical Properties**

<table>
<thead>
<tr>
<th>Product Designation</th>
<th>TEC10-9 2mm</th>
<th>TEC10-9 3mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>mm</td>
<td>2</td>
</tr>
<tr>
<td>Weight</td>
<td>g/m²</td>
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<td>thermal conductivity</td>
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<tr>
<td>thermal resistance (Rcf)</td>
<td>R-value</td>
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</tbody>
</table>

**Composition**

50-70% silica gel (trimethylsilylated), 30 - 50% oxidized fiber polyacrylonitrile

**Water absorption**

hydrophobic, repels water & therefore never feel the moisture

**Breathability**

The composition & the design allows Space Sole to breath without sacrificing the insulation value.
Ecological Information

Ecological information is based on literature review for synthetic amorphous silica (CAS No. 7631-86-9)

**Synthetic Amorphous Silica:**
- Fish: LC50 > 10,000 mg/L (Brachydanio rerio: 96 hour), Method OECD 203.
- Daphnia magna: EC50 > 10,000 mg/l (24 hours), Method OECD 202.

**Mobility:**
None expected due to insoluble nature of product.

**Persistence and Biodegradability:**
Not applicable for inorganic material.

**Bioaccumulative Potential:**
None expected due to insoluble nature of product.

**Other Adverse Effects:**
None expected.
Universal components for gloves

Ski Glove Liner
Casual Glove Liner

Ski and casual glove panels are placed between outer shell and inner lining or insulation on back hand and thumb.
Thermal Clothing Inserts

We have standard designed insulating panels for use in apparel that can be used in a variety of combinations to create varying degrees of thermal performance for different conditions.

Benefits

• Super Thermal Protection
• Minimum thickness – 2mm
• Flexible
• Washable
• Re-useable
• Breathable
• Hydrophobic
• Can be personalised
Thermal Clothing Inserts

For minimum warmth & comfort

UNIVERSAL PANELS
USED FOR MINIMUM ADDED WARMTH AND COMPRESSION ZONE COVERAGE
Thermal Clothing Inserts

For Optimum Warmth

For Extreme warmth & Compression Zone Coverage

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Using thermal imaging we can see the difference between insulating the compression areas with our nanotechnological thermal insert panels which prevent heat loss.
With Nanotechnological thermal insert panel inserts

Nanotechnological Clothing Inserts mounted internally within the garment which protects and isolates the body temperature
Aerogel inserts for Vests suitable for use in operating theatres & hospitals.
Guidelines for sewing Aerogel Inserts into a garment: Aerogel inserts for apparel is fully encapsulated and has a nylon ripstop fabric layer on one side.

The fabric layer is designed to provide a strong surface to allow the panel to be sewn into a garment. The insert cannot be sewn through.

A general rule is to allow a minimum 3/8” (10mm) clearance to the edge of the encapsulated Aerogel insert.

TEC10-9 Thermal Inserts may also be welded or tape seamed into a garment.
Innovation in the Thermal Bags

MEDICAL BAGS for transporting organs & blood

57% more efficient over a 36 hour period, than a traditional thermal bag used for transporting blood.

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In Summary, amongst the range of products, which are vast and varied, we can list the following:

• Thermal Insoles for shoe & boot manufacturers
• Thermal clothing inserts
• Thermal blankets for operating theatres
• Thermal Gloves
• Thermal bags for transporting blood, medicines, organs, etc;
• Thermal foldable seats for the soccer stadium, concerts, camping and all other external events
• Personalised products – developed & made to order

In Conclusion, the major benefit of Aerogel is it’s high thermal characteristics along with it’s reduced dimensions. This facilitates the creativeness in designing innovative, slimline products utilising state of the art technology and ensuring maximum thermal insulation.