



The next generation of cryogenic insulation

Harry Walkoff, President, H.R. Walkoff LLC, Technical Insulation Consultant, explains Alkegen's evolution of aerogel blankets and the development of a new product for LNG applications.

It is hard to believe that it has been over 15 years since the introduction, commercialisation, and subsequent successful acceptance of aerogel insulation blankets for use in the oil and gas market. The basic tenets of a superior thermal insulation in a flexible blanket format, for above and below ambient applications, for piping and equipment, has proven to be a safe, and a technically and economically beneficial solution for owners and engineers, for their hydrocarbon processing projects. More specifically, for LNG facilities aerogel insulation blanket usage for cold and cryogenic processes has increased

over time and subsequently, areas for aerogel blanket improvement have been identified.

Briefly, silica aerogel is a lightweight silica particle comprised of mainly air. Since the solid component represents a minimal portion of the volume of the material, conduction through it is very low. Much of the remaining space is composed of nanopores and the air present in the space has limited room to circulate, thereby limiting convection. The result is an extremely effective insulator, however the solid in its raw form has limited value as an insulation material for piping and equipment.

Subsequently, various methods for incorporating aerogel into an appropriate carrier or blanket for various applications have been developed.

Alkegen's AlkeGel Ember Aerogel insulation blanket for hot process applications, AlkeGel Fyre Aerogel blanket for fire protection, and AlkeGel Glacier Aerogel insulation blankets for cold and cryogenic process applications, are part of a new generation of aerogel insulation blanket. Such a blanket provides the known advantages over traditional closed cell, rigid insulation materials, while also providing



Figure 1. Microscopic SEM image of AlkeGel blanket showing aerogel particle and fibre matrix.



Figure 2. AlkeGel Glacier provides protections for facility piping and equipment from various fire hazards, for extended periods of time.

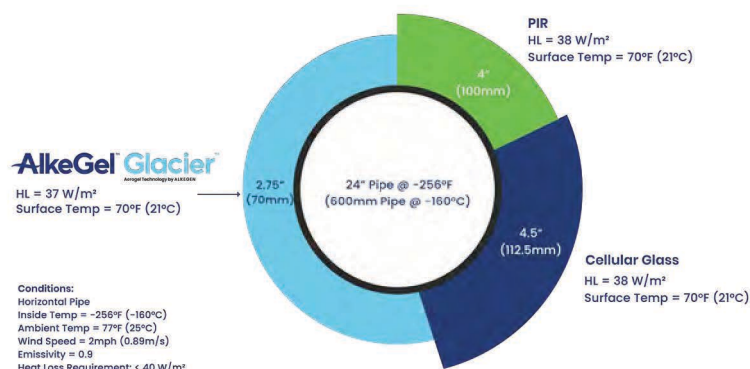


Figure 3. AlkeGel glacier thickness comparison chart.

advantages over the existing aerogel insulation blankets that are commercially available today.

Developments in blanket insulation

Alkegen (previously Unifrax and Lydall) has a history of delivering a range of solutions for industrial thermal management applications requiring lightweight and thin materials, to customers worldwide. The company specialises in producing fibre-based products for a wide range of industries. Its advanced manufacturing capabilities and technical expertise in fibre technology allows it to produce insulation materials with precise properties, ensuring optimal performance and reliability. The company offers a portfolio of insulation products which are designed to provide excellent thermal performance and stability for both hot and cold process applications.

The company's development of low-bio persistent (LBP) fibre is a case study of providing solutions for industrial markets. Insulfrax LT thermal insulation blanket from Alkegen consists of fibres that utilise a unique chemistry, produced with proprietary fibre spinning technology and which are then needled together to form the insulation blanket. Insulfrax LT Blanket, has the high temperature performance characteristics (classification temperature of 1200°C [2192°F]) required in many applications and, most importantly, was developed to meet regulatory requirements to be considered a low bio-persistent fibre blanket. Insulfrax LT Blankets were developed to provide an environmentally safe and clean, superior thermal solution for a variety of heat processing applications and industries.

Benefits include:

- Extreme temperature performance.
- Low thermal conductivity.
- Excellent thermal stability.
- Thermal shock resistance.
- Light weight.
- Great handling strength.
- Flexibility.
- Sound absorption.

The company has produced an aerogel blanket for hot and cold applications. Alkegen's efforts in this endeavour have led to the launch of the AlkeGel aerogel blanket product line (Ember, Fyre, and Glacier). The targeted developments include optimised materials, chemistry and manufacturing processes, resulting in properties and performance advantages as compared to the rigid insulation products, as well as the existing aerogel blankets that are available today. All AlkeGel flexible aerogel fibre blanket products consist of a homogenous blend of fit-for-use fibre and aerogel which

provides a thermally superior insulation blanket with substantially less dust propagation. Additionally, AlkeGel's manufacturing process is scalable and coupled with the company's global footprint, which provides assurance of product supply for oil and gas projects worldwide.

Comparison of insulation products

AlkeGel Glacier Aerogel Blankets are designed for cold and cryogenic applications, such as LNG, ethylene, LPG, ammonia, and other below ambient processes. The fibre-enhanced aerogel blanket comes with a factory applied, integral, zero-perm vapour barrier, which is commonly used in combination with insulation, for cold insulation applications.

Advantages of improved thermal performance (decreased thickness):

- Lighter weight.
- Less space required in and around piping and equipment.
- Insulation volume is decreased resulting in improved shipping and handling logistics.

AlkeGel Glacier insulation blankets meet or exceed the industry standards for thermal conductivity which results in substantially less thickness, as compared to rigid insulation products, such as polyisocyanurate and cellular glass. Decreased thickness equates to less insulation volume required and less ancillary products such as sealants and metal jacketing, to be supplied and installed. Therefore, improved thermal performance and resultant thickness advantages have a substantial positive economic impact on material and installation costs. Additionally, superior thermal performance, as compared to the rigid insulation materials, results in Glacier aerogel blanket's ability to provide fire protection and acoustic performance with less thickness required (Figures 2 and 3).

Advantages of a flexible aerogel blanket:

- Faster installation times.
- Simplified SKU's.
- Decreased storage space requirements.

- Less system design requirements (e.g., expansion/contraction joints).

The flexibility of Glacier aerogel blanket also provides many installation benefits as compared to traditional rigid, block insulation which are produced in block form which must then be cut and fabricated to the specified pipe size and thickness, and then shipped to the project site. Glacier blankets are supplied in rolls and can be easily cut to shape on site and easily wrapped onto the piping and equipment resulting in decreased total installed costs.

Utilising the company's manufacturing process, AlkeGel Glacier Fiber Enhanced Aerogel Blankets offer improved properties and value propositions, for below ambient applications for oil and gas facility owners.

Critical properties and performance

- Health and safety: Glacier blankets are 80% less dusty than traditional aerogel blankets. This results in an improved work environment for manufacturing personnel and on-site insulation installers. Decreased dust levels can eliminate many of the personal protection equipment (PPE) and on-site dust mitigation requirements that presently exist, thereby providing productivity gains, improved project schedule times and decreased costs.
- Thermal conductivity: The thermal conductivity of Glacier Aerogel Blankets meets today's industry standards. Additionally, Alkegen's manufacturing process results in a more homogenous aerogel distribution vs existing aerogel blanket products. This results in improved thermal consistency throughout the blanket. For cryogenic applications, Aerogel blankets require many layers of material to be installed and therefore Glacier's thermal uniformity and stability throughout each layer, ensures that the insulation system performs as per the project specification and the process pipe and equipment performs as thermally designed.
- Fire protection: The company's extensive expertise in critical fire protection applications extends to Glacier Aerogel Blankets. Alkegen utilises fibres historically utilised in fire protection products in the development of AlkeGel Glacier resulting in industry leading fire protection performance. AlkeGel Glacier,

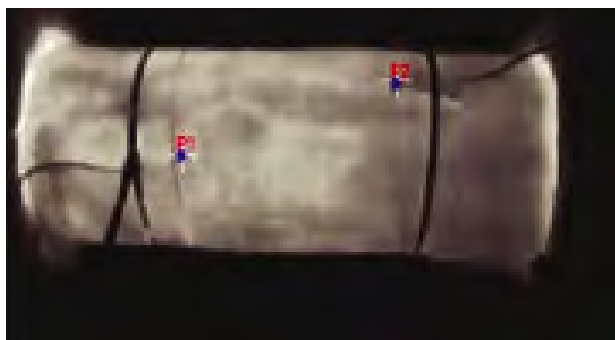
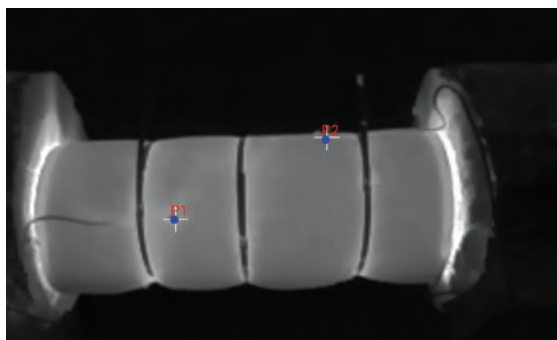


Figure 4. Infrared Thermographic comparison: AlkeGel Glacier (left) shows uniform thermal performance throughout the blanket vs traditional aerogels (right).

provides protections for facility piping and equipment from various fire hazards, for longer periods of time.

- **Acoustical performance:** Glacier blanket acoustic systems meet the industry standards for acoustic performance for facility piping and equipment. Additionally, Glacier blankets provide a more consistent noise reduction performance throughout the blanket for each layer applied.
- **Thickness:** Glacier blankets can be produced in 5 mm, and 10 mm thickness, and customised thicknesses are possible. Additionally, the thickness tolerance is more tightly controlled compared to other aerogel products, meaning there is less deviation across the blanket and, from roll to roll. The smaller deviation of the system thickness is therefore more representative of the thickness that is specified, based on the thermal insulation design.
- **Vapour permeability:** Glacier Blankets provide excellent resistance to moisture in both water and vapour form and come with a factory installed zero-perm vapour barrier. Each layer of the insulation blanket will therefore be protected by the vapour barrier thereby providing redundant resistance to water vapour ingress. In addition, Glacier's homogeneous matrix of aerogel and fibre, provide improved vapour permeability resistance, as compared to other aerogel blankets.
- **Installation and handleability:** Glacier insulation blankets are extremely flexible and easier to install onto equipment and both large-bore and small-bore piping. Glacier rolls are easy to cut to length for various piping sizes and for the fabrication of fittings, including elbows, valves, and flanges. This improved handleability leads to faster installation time and subsequent decreased installation costs and shorter construction schedules.
- **Durability:** Glacier blankets are flexible, durable, and designed for cryogenic temperatures. They maintain their initial properties over time, even after excessive flexing during installation and cutting during fabrication. The material also resists compression and load damage from impact and foot traffic.

Meeting challenges of increased demand

Aerogel blankets have become an accepted insulation material for both hot and cold applications with numerous advantages over other insulation products. As a result, demand for aerogel blankets for use in LNG, and other oil and gas projects, has grown and aerogel blanket production capacity has become a concern.

AlkeGel Glacier aerogel blankets, which are now being produced, offer improved properties and performance which is further enhanced by its minimal dust propagation levels, as compared to existing aerogel blanket products. As a result, simplified and faster installation times are realised which has a positive

impact on labour, construction schedules, and total installed costs. Glacier's strong value proposition is anticipated to further advance the use of aerogel blankets in the market.

The increasing demand for aerogel blankets, for LNG and other projects, has made capacity a critical factor for the owners, engineers, and contractors of these facilities and therefore optimising the raw materials required and designing an efficient and scalable manufacturing process, was a priority for Alkegen.

AlkeGel blankets are manufactured with their own proprietary fibre that can be produced at their existing factories worldwide. Other aerogel blanket manufacturers rely on fibre supply from third parties, which can lead to supply and logistic issues. Also, AlkeGel's process is continuous which offers advantages over other aerogel blankets which are produced via batch processes. AlkeGel's continuous production provides increased productivity rates and is easily replicated at Alkegen's global facilities utilising existing assets.

Alkegen Aerogel Blankets are presently produced in the US and plans are underway to add new manufacturing facilities in Europe and Asia to meet the increased global demand to ensure that projects under construction can be insulated on a cost-effective basis and completed on schedule. [LNG](#)



Figure 5. AlkeGel is a flexible insulation blanket providing low dust and ease of installation.



Figure 6. AlkeGel is easy to cut and offers excellent handleability.

INTRODUCING

Low Dust
Lightweight
Easy to Cut

AlkeGel GlacierTM

Aerogel Technology by Alkegen

AlkeGel GlacierTM is part of our new portfolio of ultra low dust aerogel insulating technology materials, engineered to minimize heat transfer and liquid boil-off in cryogenic applications.

AlkeGel Glacier offers improved energy efficiency, lower greenhouse gas emissions, asset protection from fire and ice, and a zero-permeability integral vapor barrier.

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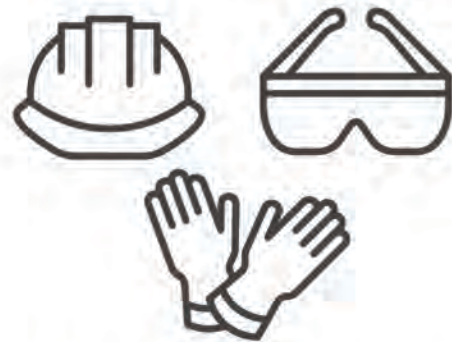
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Installing Aerogel Insulation 101

THEIRS



OURS



AlkeGel Glacier
Aerogel Technology by ALKEGEN

AlkeGel Ember
Aerogel Technology by ALKEGEN

AlkeGel Fyre
Aerogel Technology by ALKEGEN

LESS DUST = FASTER INSTALLATION

Compared to traditional aerogel blankets, Alkegen's aerogel insulation technology has 80% less dust and can be installed 20% faster.

AlkeGel offers excellent handleability; it is easy to cut, lightweight, and gets the job done without the expensive PPE that traditional aerogels require. Specify AlkeGel on your next project.

ALKEGEN

For more information contact us today: alkegen.com/contact-us