New tools and technology for the offshore industry

Offshore®

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Aspen Aerogels offers innovative insulation solution for offshore production

Aspen Aerogels, a supplier of nanotechnology-enabled aerogels for insulating applications, has been making inroads into the offshore oil and gas sector. As offshore wellheads are placed farther away from production platforms and transportation of crudes becomes increasingly sensitive to keeping the flowing temperature above certain thresholds, effective thermal insulation becomes increasingly important.

In the transportation of very paraffinic crudes or wet gas, for example, the product must be kept above the temperature at which paraffin crystals or hydrates begin to form and cause potential flow assurance and plugging challenges. In order to prevent this from occurring at near-freezing subsea temperatures, various insulating technologies have been developed to keep the internal temperature of the pipe above the threshold for flow assurance problems.

The same can be said for the transportation of LNG. The product must be kept in liquid form at cryogenic temperatures until it reaches onshore regasification terminals, whether it is shipped via ocean-going vessels or within transfer lines.

For these reasons, oil well lines, LNG tankers and transfer lines must be heated, super cooled or insulated to maintain product temperature and thus ensure efficient and uninterrupted operation. Heat tracing of lines has been implemented for some offshore projects, but by and large the preferred solution has been through the use of insulation.

An insulation's measure of effectiveness lies in the value of its thermal conductivity. This is a measure of the amount of heat that is transmitted through a given thickness of material in a direction perpendicular to a surface of area. The driving force for this transfer of heat is a temperature gradient between opposite sides of the material. A low thermal conductivity (denoted by k) means that the insulating material is effective at reducing the quantity of heat transmitted through it.

Up until recently, the offshore oil and gas industry has been forced to rely on insulation with higher-than-desired thermal conductivities. As a result, the insulation has been thicker-than-desired, driving up the size of the piping system and hence the cost.

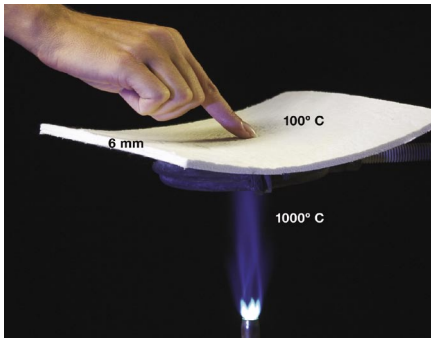
Aspen Aerogels has changed the game by offering nanotechnology-enabled aerogels with insulating properties that outperform most conventional materials by a factor of 2 to 8. The improvement with aerogels comes from their structure. They have nanometer-scale pores that are less than 1/3000th the width of a human hair. These incredibly small pores significantly reduce the mean free path for gas molecules, which translates into significantly reduced energy and mass transport, making them excellent insulators.

While aerogels were first synthesized in 1931, their original manufacturing process made large-scale commercial applications nearly impossible. The aerogels are formed in a polymerization reaction, in which polysilicic acid forms a solid network structure that retains the processing solvent water in its matrix. The water is removed and replaced with air in a complicated and lengthy drying process that can take several days. In addition, once they are dry, most aerogels are stiff and brittle constructs that cannot be easily manipulated.

Aspen perfected proprietary methods of processing and drying aerogels, which resulted in reducing drying time down to just a few hours. They also isolated aerogels into the form of thin and flexible blankets, which allowed for easier installation around pipe work and tanks. These blankets are extremely lightweight and easy to apply and handle. Aspen's Spaceloft brand of insulating sheets can be cut using conventional textile cutting tools and in many instances can be applied without the use of bonding agents. Their hydrophobic nature also means that piping containing the aerogel insulation can be stored outside prior to installation without fear of water ingress into the insulation.

The cost savings afforded with using thinner insulation with lower thermal conductivity are two-fold. Firstly, thinner insulation with improved thermal performance means that smaller pipe systems can be utilized, with reduced costs. For example, in typical pipe-in-pipe construction, the use of Aspen Aerogel's insulation enables the outer pipe to be reduced by at least one standard pipe size without impacting the thermal conductivity of the system.

The benefit of reduced pipe size also translates to more pipe that can be loaded on ship, which results in fewer trips from port to sea to complete the installation.



An example of the aerogel's insulating capacity. After 5.5 hr, the insulation prevents the majority of the heat from traveling through the material.

The offshore sector has responded to Aspen's offering with an increasing number of orders. Customers in the GoM include Agip Petroleum and Kerr-McGee. Agip's K2 offshore oil development is located in Green Canyon block 562 in a water depth of 1,100 m. The subsea pipeline will be fabricated and installed utilizing Aspen Aerogel's Spaceloft AR5103 insulation in a pipe-in-pipe construction. AR5103 is only 0.25 in thick and is available in sheets of 59 in. by 200 ft.

Kerr-McGee's Ticonderoga project will also utilize Aspen Aerogels technology for a pipe-in-pipe application on their subsea flowlines. Aspen was awarded this contract in May 2005, the fourth project that will use AR5130 insulation.

Orders are coming in for offshore products internationally as well. In November of 2004, Aspen Aerogels accepted a $6 million order from Technip to supply AR5103 panels for the oil flow lines for Total's Dalia project, offshore Angola. That same month, Saipem awarded a $500,000 order to Aspen for fabricated AR5103 panels for the risers to the production platform for the Rosa field, also offshore Angola. •

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SAVE MILLIONS WITH ASPEN AEROGELS PIPE-IN-PIPE INSULATION

k- Value (ambient)

Material	W/m-K	Btu-in/hr•ft²•° F
Aspen Aerogels' Spaceloft™ 6250	0.012	0.084
Microporous Silica	0.022	0.154
Polyurethane Foam	0.028	0.196
Expanded Perlite	0.040	0.280
Fiberglass	0.040	0.280
Cellular Glass	0.050	0.350

*Aspen Aerogels provides **2 to 3** times more insulating capacity than competing PIP insulating materials.*

Aspen Aerogels' pipe-in-pipe insulation reduces carriers between 1 and 6 pipe diameters with no compromise in U values and flow rates. That's saving a lot of steel costs and weight, so you can go deeper and longer. Aspen Aerogels insulation means:

- Reduction of steel costs through reduced carrier line sizes
- Reduction of weight leads to more pipe on lay vessels
- Weight reduction also means lower hang-off weight for floating platforms
- Significant total system savings

What's more it's already proven in more than 246,000 feet of undersea pipe-in-pipe applications. Learn how Asppen Aerogels can save you millions in pipe-in-pipe systems now by going to:

www.aerogel.com, or call us at 1.888.481.5058, Ext. 1162. Outside US and Canada, please call +1.508.691.1111, Ext. 1162.

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