www.inteletex.com

Solid air

The remarkable properties of aerogels are trickling down into commercial applications including extreme insulation clothing

Corpo Nove's Winter Extreme jacket

The Winter Extreme jacket manufactured by Italian clothing company Corpo Nove is one of a number of products containing aerogel which are expected to become a commercial reality this year.

The aerogel insulation blanket produced by Aspen Aerogels in the US and employed as a lining for the Winter Extreme is said to be three times more effective than 3M's Thinsulate. Aerogel is packed with microscopic insulative air pockets that make it impossible for most gas molecules, including air, to pass through, resulting in virtually zero heat loss.

Aspen, just three years old as a company, is already profitable, with revenues of around $2 million this year. But by 2005, the company believes its sales will be nearer the $100 million mark.

Aerogels were first invented by Dr Steven Kistler in the 1930s, but have been the subject of much intensive development work over the past 20 years. They are basically produced by creating gelatinous structures and then removing all liquid without any shrinkage.

Aerogel insulation blanket produced by Aspen Aerogels

The lightest of all known solid materials, aerogels are just three times as dense as air. In fact, they are over 90% air anyway, being composed of extremely high density interconnected pores of silica, alumina, carbon or other such materials with diameters of less than 100 nanometers. This gives them a very high surface area ranging from 400 to 1,000 square metres per gram.

Here are some other facts about them:

- They can be 39 times more insulating than the best fibreglass insulation.
- They are 1,00 times less dense than glass.
- A wafer thin layer is sufficient to protect a hand from a blowtorch just inches away from it.
- A block the size of a person weighs less than a pound, looks like it would blow away in a slight breeze, yet could support a small car.
- They were used as insulation on the rover vehicle of the Mars Pathfinder.

The Marshall Space Flight Center has already provided specifications for aerogels to over 50 companies and research institutes for products as diverse as diving suits, industrial insulation, medical containers and windows.

Aspen Aerogels is likely to find its biggest first market in the home-construction industry, rather than fashion. As a replacement for fibreglass aerogel could yield huge savings in raw materials and also cut heating bills - in clear gel form it can also be placed between double-glaze windows.

Until now, price has been the sticking point, but Aspen now has the potential to produce ten million square feet of Aerogel per year and make become price-competitive with fibreglass.

In 1999 Aspen introduced a high-speed, low-cost manufacturing process for aerogels, for which it received the US Small Business Innovation Research Technology of the Year Award in Manufacturing/Materials.

Aspen president Kang P. Lee said that the new process provides dramatic cost reductions in the manufacture of aerogels, which it can now mass produce for the building insulation, skylights/windows, clothing, home appliances, aerospace, automotive and cryogenics sectors. A 1,000 litre pilot plant started production late in 2001, built as part of an ongoing US Department of Energy (DOE) sponsored Phase II NASA Small Business Innovation Research (SBIR) contract.

Mr Lee explained that Aspen Systems, a relatively new entrant in the long history of aerogel development, started working on aerogels under an SBIR contract in 1993 to develop flexible aerogel blankets for cryogenic applications at Kennedy Space Center. This work resulted in a patented product.

Over the next eight years, it received approximately $5 million spread over seven contracts specifically for the US government's various aerogel needs.

In addition to its high speed, another crucial characteristic of Aspen's process is that its speed can be virtually independent of production equipment size. This is in stark contrast to the conventional supercritical aerogel drying method. The new process can be used for producing large aerogel panels or blankets in a fast batch process. The same method will dry aerogel beads in such a short period that connecting multiple extractors to a single wet gel process stream will approach the functionality of a fast continuous process.

Textile Month – 19/11/2003