Polymer-reinforced aerogel found resilient for space missions

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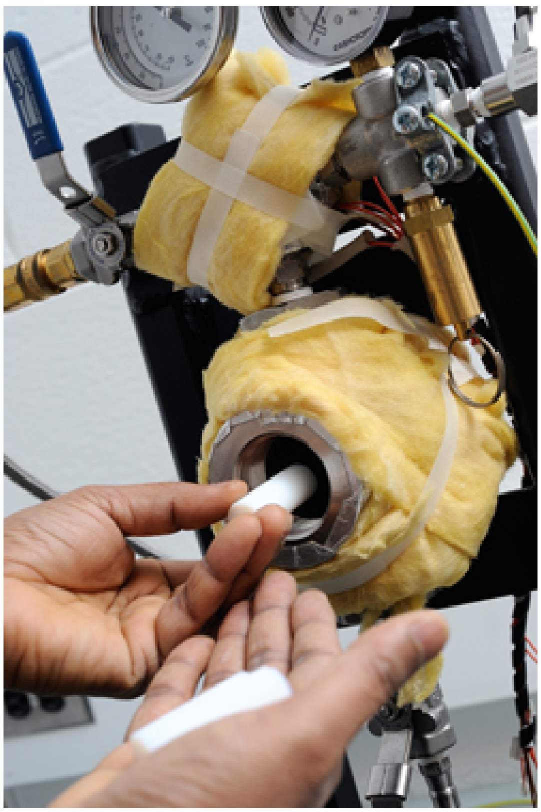

The supercritical aerogel dryer was built by UA polymer engineering graduate student Andrew Shinko.

Polymer-reinforced aerogels could soon go on a space mission. Modifying the mechanical properties of aerogels with a polymer reinforcement creates a durable thermal insulator primed for aerospace, according to recently published research by Dr. Sadhan C. Jana, University of Akron Department of Polymer Engineering chair and professor, UA Ph.D. graduate Jason Randall and NASA Glenn Research Center collaborator Dr. Mary Ann Meador.

"Tailoring Mechanical Properties of Aerogels for Aerospace Application," featured as a spotlight article in the March 23, 2011, edition of the American Chemical Society's Applied Material & Interfaces describes how polymer-strengthened silica aerogels maintain their effectiveness as thermal insulators under supercritical conditions of outer space, including temperature and pressure extremes.

Polymer improves strength and flexibility

Low thermal conductivity and low density make silica aerogels ideal insulators, according to Jana, yet their fragility often counters their prospective effectiveness, particularly in aerospace applications. Comprised of approximately 95 percent air and 5 percent silica, the delicate aerogels typically break down under relatively low stresses. However, a polymer conformal coating on the silica nanoskeleton not only improves the strength of aerogels, but their elasticity and flexibility as well.

"Consequently, you now have a material capable of withstanding compression and bending stresses as well as temperature extremes, making it a candidate for use on space rovers, inflatable decelerators and EVA suits," says Jana, whose team research examined density, pore structure, modulus and elastic recovery of epoxy-reinforced aerogels.

Subsequent research could lead to streamlined methods for applying the polymer reinforcement to aerosol articles and expanding their use and configuration. As flexible thin sheets, for example, aerogel insulation material can be wrapped easily around pipes or tanks, using shape memory properties of the polymer reinforcement, or can be produced in net shapes obviating secondary processing or secondary handling, according to Jana.

Provided by University of Akron