Aerogel Composites

VCU Innovation Gateway
Office of the Vice President for Research and Innovation

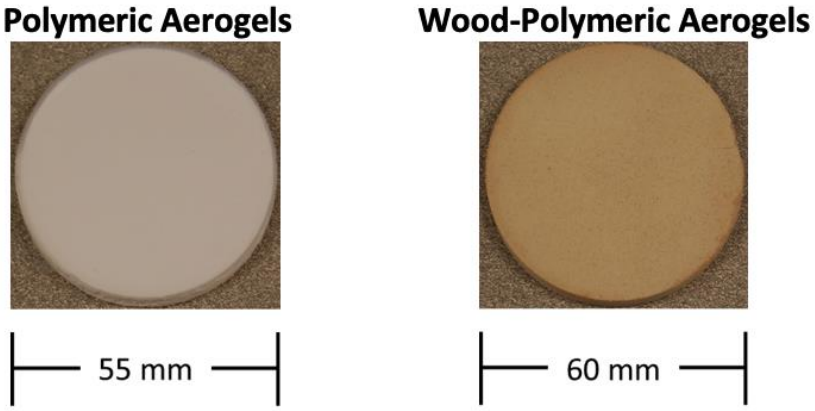
Aerogel compositions

With improved material properties and more efficient manufacturing methods

Aerogels are a unique class of materials that offer desirable characteristics such as high surface area, high porosity, low density, low thermal conductivity, and a highly crosslinked structure. Currently, aerogels fabricated from wet gels filled with solvent and other precursory materials. However, the supercritical solvents that are used to prevent cracking and pore collapse become increasingly hazardous and expensive when scaled up. These solvents also affect molding materials which limits the ability to form the aerogels into custom shapes. Therefore, aerogels are currently limited to niche applications as they are mechanically fragile. For aerogels to become more versatile, their mechanical properties need to be improved. Ideally, these materials should be strong enough to withstand common manufacturing practices such as drilling and nailing.

The technology

Dr. Bertino is dedicated to developing versatile high-performance aerogels at a low cost. He has developed several "mechanically enhanced" aerogels which can be used for a variety of applications. These aerogels can be custom-shaped and are developed through Dr. Bertino's unique fabrication methods, which can be scaled up to significantly reduce production hazards and reduce production cost by up to 50%. These manufacturing processes allow for them to be produced through ambient pressure drying and freeze-drying methods, versus expensive supercritical drying methods. Additionally, these aerogels have several enhanced properties compared to traditional aerogels, making them suitable for a wider variety of applications.



Ambient Pressure Drying Aerogels

Fabricating aerogels in ambient conditions requires the gelation solvent to be replaced with an organic solvent that can freeze at/above room temperature. It also requires that the solvent not form hydrogen bonds with the skeleton of the aerogel. This allows the solvents to evaporate when left in ambient conditions and provides an aerogel with a similar porosity and density as those developed with freeze drying methods.

Freeze Drying Aerogels

To freeze dry aerogels, the wet gel is frozen in lieu of using a supercritical solvent drying process. The frozen gel is then placed in a vacuum chamber, where the solvent is removed by sublimation. This process allows for the fabrication of custom-shaped aerogels, reduces the costs of production by roughly 50%, and significantly reduces production hazards.

Benefits

- Low thermal conductivity
- Increased durability
- Improved porosity
- Improved density
- Fire resistant
- Composite friendly

Applications

- Lightweight, durable materials
- DoD applications
- Building insulation
- Acoustic dampening
- Transparent Insulation (Silica Aerogel)

Patent status:
Patented & patent pending: U.S. and foreign rights are available.
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US 11,046,830 B2
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License status:
This technology is available for licensing to industry for further development and commercialization.

Category:
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