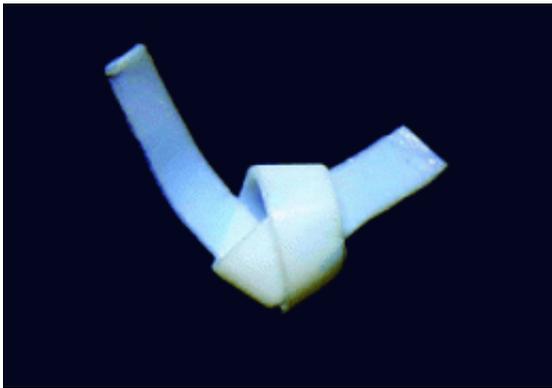


Light but stable: novel cellulose-silica gel composite aerogels

January 27 2012



(PhysOrg.com) -- Delicate and translucent as a puff of air, yet mechanically stable, flexible, and possessing amazing heat-insulation properties—these are the properties of a new aerogel made of cellulose and silica gel. Researchers led by Jie Cai have introduced this novel material, which consists almost completely of air, in the journal *Angewandte Chemie*.

Gels are familiar to us in forms like Jell-O or hair [gel](#). A gel is a loose molecular network that holds liquids within its cavities. Unlike a sponge, it is not possible to squeeze the liquid out of a gel. An aerogel is a gel that holds air instead of a liquid. For example, aerogels made from silicon dioxide may consist of 99.98 % air-filled pores. This type of

material is nearly as light as air and is translucent like solidified smoke. In addition, it is not flammable and is a very good insulator—even at high temperatures. One prominent application for aerogels was the insulation used on space shuttles. Because of their extremely high inner surface area, aerogels are also potential supports for catalysts or pharmaceuticals. Silica-based aerogels are also nontoxic and environmentally friendly.

One drawback, however, has limited the broader application of these airy materials: silica-based aerogels are very fragile, and thus require some reinforcement. In addition to reinforcement with synthetic polymers, biocompatible materials like [cellulose](#) are also under consideration.

The researchers at Wuhan University (China) and the University of Tokyo (Japan) have now developed a special composite aerogel from cellulose and silicon dioxide. They begin by producing a cellulose gel from an alkaline urea solution. This causes the cellulose to dissolve, and to regenerate to form a nanofibrillar gel. The cellulose gel then acts as a scaffold for the silica gel prepared by a standard sol–gel process, in which a dissolved organosilicate precursor is cross-linked, gelled, and deposited onto the cellulose nanofibers. The resulting liquid-containing composite gel is then dried with supercritical carbon dioxide to make an aerogel.

The novel [composite](#) aerogel demonstrates an interesting combination of advantageous properties: mechanical stability, flexibility, very low thermal conductivity, semitransparency, and biocompatibility. If required, the cellulose part can be removed through combustion, leaving behind a [silicon dioxide](#) aerogel. The researchers are optimistic: "Our new method could be a starting point for the synthesis of many new porous materials with superior properties, because it is simple and the properties of the resulting aerogels can be varied widely."

More information: Jie Cai, Cellulose–Silica Nanocomposite Aerogels by In Situ Formation of Silica in Cellulose Gel, *Angewandte Chemie International Edition*, [dx.doi.org/10.1002/anie.201105730](https://doi.org/10.1002/anie.201105730)

Provided by Wiley

Citation: Light but stable: novel cellulose-silica gel composite aerogels (2012, January 27)
retrieved 20 September 2024 from
<https://phys.org/news/2012-01-stable-cellulose-silica-gel-composite-aerogels.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.