Penn Physicists Develop a Carbon Nanotube Aeroegel Optimizing Strength, Shape and Conductivity

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Researchers at the University of Pennsylvania have created low-density aerogels made from carbon nanotubes, CNTs, that are capable of supporting 8,000 times their own weight. The new material also combines the strength and ultra-light, heat-insulating properties of aerogels with the electrical conductivity of nanotubes.

Aerogels are novel, semi-transparent, low-density materials created by replacing the liquid component of a gel with gas and are normally constructed from silicon dioxide or other organic polymers. They are currently used as ultra-light structural materials, radiation detectors and thermal insulators. Aerogels made from CNTs offer advantages to current aeroegels that point towards future applications in chemical or biological sensors.

A collaboration led by Arjun G. Yodh and Jay Kikkawa of the department of Physics and Astronomy at Penn created the aerogels by freeze-drying or critical-point-drying CNT networks suspended in fluid. The process produces a carbon nanotube network whose carbon concentration, electrical conductivity and strength can be manipulated. Critical-point-drying demonstrated reproducible conductivity in the aerogels.

The findings were reported in the journal *Advanced Materials*.

The team also maintained control of the density, microscopic structure and shape of the CNT aerogels. Normally, carbon nanotube composites can be fragile, depending on the dispersion of carbon nanotubes throughout the composite. The addition of polyvinyl alcohol created a more even dispersion of CNT throughout the aerogel, adding strength.

The study was conducted by Yodh, Kikkawa, Mateusz B. Bryning, Daniel E. Milkie and Lawrence A. Hough of Penn's Department of Physics and Astronomy and Mohammad F. Islam of the Department of Chemical Engineering at Carnegie Mellon University.

Source: University of Pennsylvania