New material could be used for energy storage

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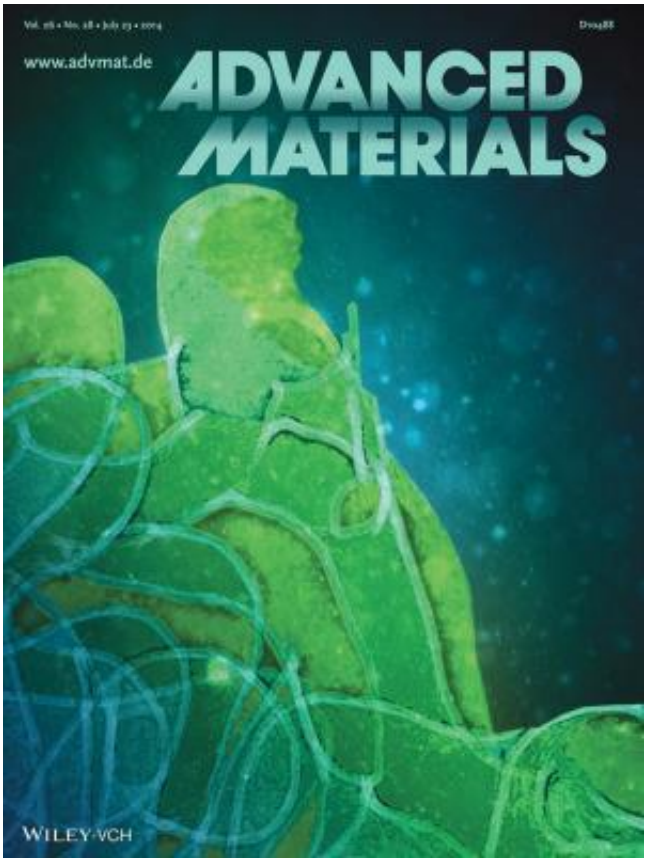

Lawrence Livermore National Laboratory researchers have made a material that is 10 times stronger and stiffer than traditional aerogels of the same density, which is detailed in a featured story appearing on the cover of *Advanced Materials*.

(Phys.org) —Lawrence Livermore researchers have made a material that

is 10 times stronger and stiffer than traditional aerogels of the same density.

This ultralow-density, ultrahigh surface area bulk material with an interconnected nanotubular makeup could be used in catalysis, energy storage and conversion, thermal insulation, shock energy absorption and high energy density physics.

Ultralow-density porous bulk materials have recently attracted renewed interest due to many promising applications.

Unlocking the full potential of these materials, however, requires realization of mechanically robust architectures with deterministic control over form, cell size, density and composition, which is difficult to achieve by traditional chemical synthesis methods, according to LLNL's Monika Biener, lead author of a paper appearing on the cover of the July 23 issue of *Advanced Materials*.

Biener and colleagues report on the synthesis of ultralow-density, ultrahigh surface area bulk materials with interconnected nanotubular morphology. The team achieved control over density (5 to 400 mg/cm3), pore size (30 um to 4 um) and composition by atomic layer deposition (ALD) using nanoporous gold as a tunable template.

"The materials are thermally stable and, by virtue of their narrow unimodal pore size distributions and their thin-walled, interconnected tubular architecture, about 10 times stronger and stiffer than traditional aerogels of the same density," Biener said.

The three-dimensional nanotubular network architecture developed by the team opens new opportunities in the fields of energy harvesting, catalysis, sensing and filtration by enabling mass transport through two independent pore systems separated by a nanometer-thick 3D

membrane.

Other Livermore authors include Jianchao Ye, Theodore Baumann, Y. Morris Wang, Swanee Shin, Juergen Biener and Alex Hamza.

More information: "Ultra-Strong and Low-Density Nanotubular Bulk Materials with Tunable Feature Size" onlinelibrary.wiley.com/doi/10 … adma.v26.28/issuetoc

Provided by Lawrence Livermore National Laboratory