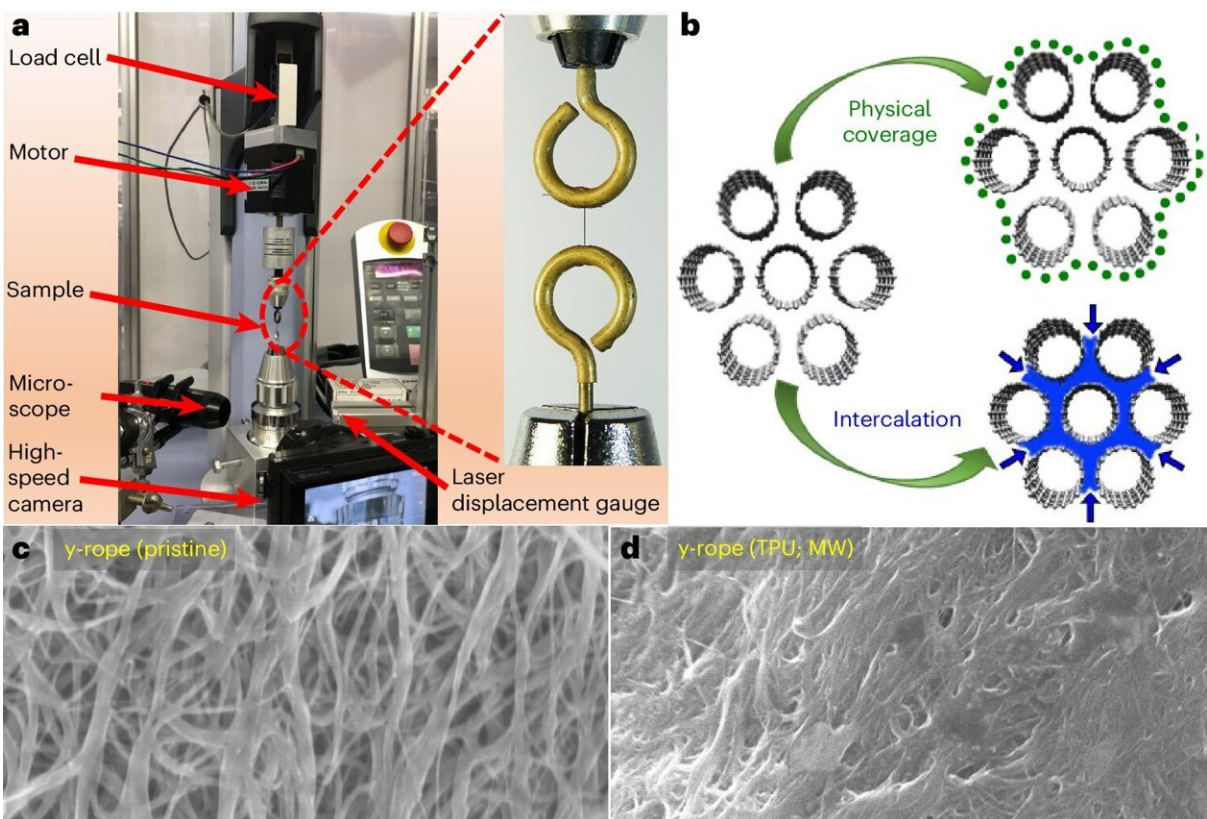


Twisted carbon nanotubes could achieve significantly better energy storage than advanced lithium-ion batteries

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Equipment and measurement of the GED of twisted SWCNT ropes. Credit: *Nature Nanotechnology* (2024). DOI: 10.1038/s41565-024-01645-x

An international team of scientists, including two researchers who now

work in the Center for Advanced Sensor Technology (CAST) at UMBC, has shown that twisted carbon nanotubes can store three times more energy per unit mass than advanced lithium-ion batteries. The finding may advance carbon nanotubes as a promising solution for storing energy in devices that need to be lightweight, compact, and safe, such as medical implants and sensors. The research [was published](#) recently in the journal *Nature Nanotechnology*.

Sanjeev Kumar Ujjain, from CAST, was a lead researcher on the work. He started the project while at Shinshu University, in Nagano, Japan, and continued after arriving at UMBC in 2022. Preety Ahuja, from CAST, also contributed to the material characterization aspects of the research.

The researchers studied [single-walled carbon nanotubes](#), which are like straws made from pure carbon sheets only 1-atom thick. Carbon nanotubes are lightweight, relatively easy to manufacture, and about 100 times stronger than steel. Their amazing properties have led scientists to explore their potential use in a wide range of futuristic-sounding technology, including [space elevators](#).

To investigate carbon nanotubes' potential for storing energy, the UMBC researchers and their colleagues manufactured [carbon nanotube](#) "ropes" from bundles of commercially available nanotubes. After pulling and twisting the tubes into a single thread, the researchers then coated them with different substances intended to increase the ropes' strength and flexibility.

The team tested how much energy the ropes could store by twisting them up and measuring the energy that was released as the ropes unwound. They found that the best-performing ropes could store 15,000 times more energy per unit mass than steel springs, and about three times more energy than lithium-ion batteries.

The stored energy remains consistent and accessible at temperatures ranging from -76 to +212 °F (-60 to +100 °C). The materials in the carbon nanotube ropes are also safer for the human body than those used in batteries.

"Humans have long stored energy in mechanical coil springs to [power devices](#) such as watches and toys," Kumar Ujjain says. "This research shows twisted carbon nanotubes have great potential for mechanical energy storage, and we are excited to share the news with the world."

He says the CAST team is already working to incorporate twisted carbon nanotubes as an energy source for a prototype sensor they are developing.

More information: Shigenori Utsumi et al, Giant nanomechanical energy storage capacity in twisted single-walled carbon nanotube ropes, *Nature Nanotechnology* (2024). [DOI: 10.1038/s41565-024-01645-x](https://doi.org/10.1038/s41565-024-01645-x)

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