Researchers demonstrate breakthrough recyclability of carbon nanotube sheets

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Graphical abstract. Credit: *Carbon* (2024). DOI: 10.1016/j.carbon.2024.118851

Researchers at IMDEA Materials Institute have demonstrated for the first time the recyclability of high-performance carbon nanotube (CNT) sheets while maintaining their essential mechanical and electrical properties.

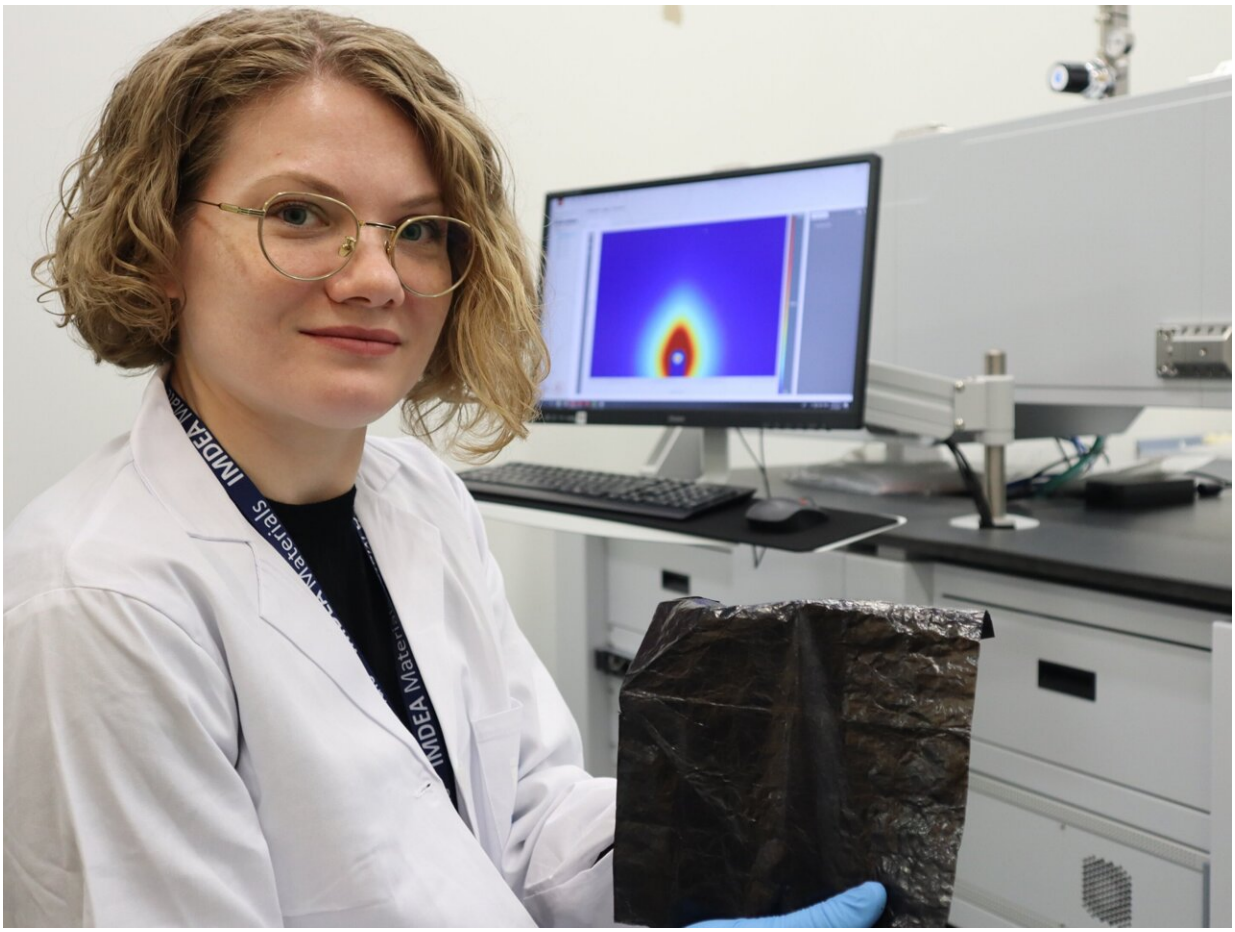
The paper outlining the work, "Network structure enabling re-use and near full property retention in CNT sheets recycled from thermoset composites," was published in the journal *Carbon*.

It represents a significant advance in sustainable nanostructured materials and holds promise for carbon nanotube fibers, sheets, and textiles to play a pivotal role in the future transition to green energy.

"Even three years ago, there was little interest in recycling CNT-based materials and this research is the first attempt in this direction," explained Dr. Anastasiia Mikhalchan, Senior Research Associate at IMDEA Materials Institute.

"It demonstrates that high-performance materials made from carbon nanotubes can be reused as structural reinforcement or electrical conductors. This is due to the fact that neither their continuity, alignment and mechanical properties, nor their conductivity is affected by this recycling process."

"These will be able to displace widespread CO_2-intensive materials, such as conventional carbon fibers and some metals like copper, decreasing our future CO_2 emissions footprint."



IMDEA Materials researcher Dr. Anastasiia Mikchalchan with a recycled carbon nanotube sheet. Credit: IMDEA Materials Institute

The recycled carbon nanotube sheets retain their key mechanical properties, including their flexibility. Credit: IMDEA Materials Institute

The work utilizes carbon nanotubes rapidly grown and directly assembled into freestanding network materials by means of floating catalyst chemical vapor deposition (FCCVD) synthesis process.

These CNT fibers and sheets possess high structural toughness and flexibility as well as high mechanical, electrical and thermal properties which enables their usage in structural reinforcement in composite laminates, as well as printable strain/stress sensors, electrical conductors, and flexible battery anodes etc.

With the global CNT production capacity increasing annually, recycling CNT-based materials has become a pertinent topic. The research conducted by IMDEA Materials is expected to catalyze the scale-up of

manufacturing high-performance CNT materials and accelerate their adoption by the industry.

More information: Anastasiia Mikhalchan et al, Network structure enabling re-use and near full property retention in CNT sheets recycled from thermoset composites, *Carbon* (2024). DOI: 10.1016/j.carbon.2024.118851

Provided by IMDEA Materials