

Old Paper Bags and Cardboard Boxes Could Find New Life in Safe Yet Powerful Lithium-Ion Batteries

Creating tiny sculptures from laser-cut laminated kraft paper, a team of researchers may have found a green material for lithium-ion anodes.



Gareth Halfacree

Follow

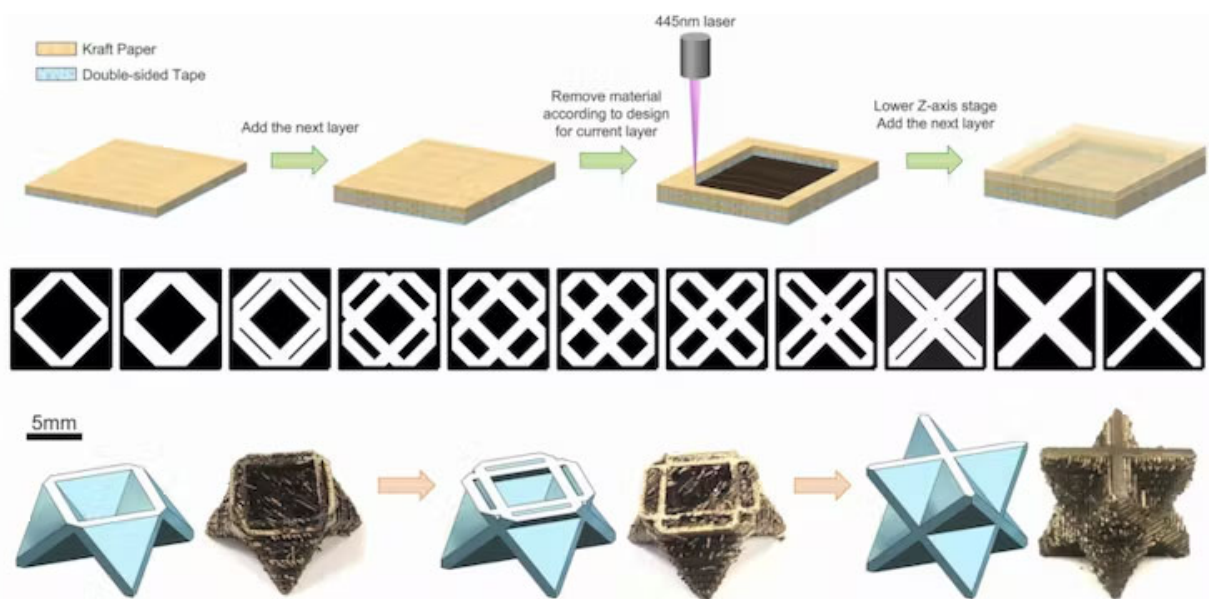
11 hours ago • Sustainability / Upcycling / HW101



Ad

Researchers at Nanyang Technological University have come up with a way to turn waste paper into a material for use in high-capacity lithium-ion batteries for smartphones and electric vehicles — an ideal and eco-friendly use, they say, for single-use packaging like paper bags and cardboard boxes.

"Paper is used in many facets in our daily lives, from gift wrapping and arts and crafts, to a myriad of industrial uses, such as heavy-duty packaging, protective wrapping, and the filling of voids in construction," says project lead Lai Changquan, an assistant professor in NTU's school of mechanical and aerospace engineering. "However, little is done to manage it when it is disposed of, besides incineration, which generates high levels of carbon emissions due to their composition. Our method to give kraft paper another lease of life, funneling it into the growing need for devices such as electric vehicles and smartphones, would not only help cut down on carbon emissions but would also ease the reliance on mining and heavy industrial methods."

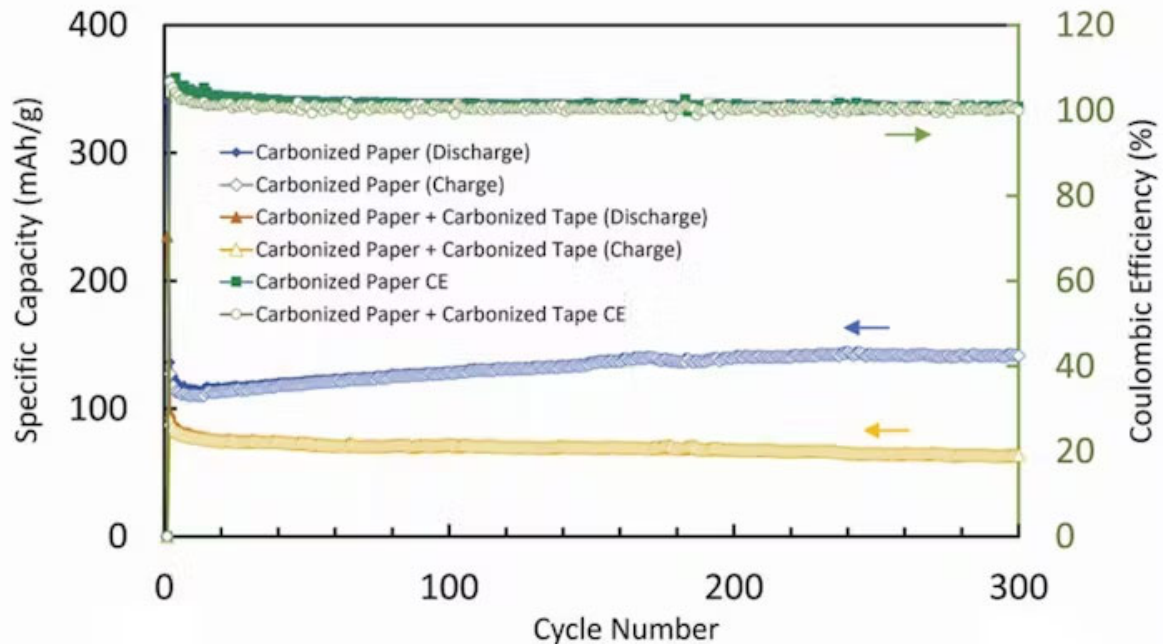


Laser-cut sculptures of kraft paper, exposed to extreme heat, could drive safer and more powerful battery breakthroughs. (📷: Lai et al)

The team's work sees thin sheets of kraft paper laser-cut and reassembled via sheet lamination into lattices of varying shapes, before exposing the paper to a high-temperature oxygen-free environment to pyrolyze it without burning the material. The result is what the team call paper-derived architected carbon foams (PDACFs), which have an "unprecedented combination of strength and energy absorption" — including a compressive resilience similar to graphene aerogels but at stress several orders of magnitude higher.

It's the material's use as the anode in lithium-ion batteries that is of most interest, however, demonstrating improved safety and a high energy capacity, which could make them a key material for next-generation smartphone, laptop, and electric vehicle power sources. "Our anodes displayed a combination of strengths, such as durability, shock absorption,

[and] electrical conductivity, which are not found in current materials," claims co-author Lim Guo Yao. "These structural and functional properties demonstrate that our kraft paper-based anodes are a sustainable and scalable alternative to current carbon materials, and would find economic value in demanding, high-end, multifunctional applications, such as the nascent field of structural batteries."



The material proved suitable for use in batteries, sustaining its capacity over 300 charge-discharge cycles. (📷: Lai et al)

"Our method converts a common and ubiquitous material – paper – into another that is extremely durable and in high demand," adds Lai. "We hope that our anodes will serve the world's quickly growing need for a sustainable and greener material for batteries, whose manufacturing and improper waste management have shown to have a negative impact on our environment."

The team's work has been published under open-access terms in the journal [Additive Manufacturing](#).

physics

recycling

sustainability

battery

power supply



Gareth Halfacree

Follow

Freelance journalist, technical author, hacker, tinkerer, erstwhile sysadmin. For hire: freelance@halfacree.co.uk