

factors, including voltage, capacity, energy density, and power density. Credit: Hongsen Li et al. ©2016 The Royal Society of Chemistry

materials." *Energy & Environmental Science*. DOI: [10.1039/c6ee00794e](https://doi.org/10.1039/c6ee00794e)

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By fabricating electrodes out of nanostructured materials with layered crystal structures (nanotubes for the [anode material](#) and ultrathin nanosheets for the cathode material), the researchers here demonstrated a battery that addresses many performance and safety criteria. These factors include the rate of sodium ion insertion/extraction (or voltage), as well as the rate capability (how quickly the battery can charge/discharge).

Overall, the nanostructured electrode materials used here have achieved what the researchers believe to be the best combination yet of battery characteristics: along with the high energy density mentioned above, the battery also exhibits a high operating voltage (about 3V), large reversible capacity, high rate capability, thermal stability over a wide temperature range, and high capacity retention (over 92% after 100 cycles).

With these characteristics, the researchers expect that the new sodium-ion full-cell battery will be a promising candidate for future large-scale energy storage, such as storing energy generated by wind and solar technologies, as well as electric vehicles.

"Practical applications of sodium-ion full batteries have been hindered by many limitations, such as low working potential, large capacity decay during cycles (short cycle life), and low safety," Yu told *Phys.org*. "In the next stage, we are aiming to solve the aforementioned issues by continuing to search for more promising electrode materials with a much longer cycle life (from a few hundred to thousands of cycles), as well as higher energy and power densities. In addition, replacing the high volatile and flammable organic electrolytes with solid-state electrolytes or quasi-solid-state electrolytes may provide another promising direction to build long-term safer [sodium-ion batteries](#)."

More information: Hongsen Li *et al.* "An advanced high-energy sodium ion full battery based on nanostructured Na₂Ti₃O₇/VOPO₄ layered

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