# Scientists propose ultrahigh-fraction active anode for sodium dual-ion batteries

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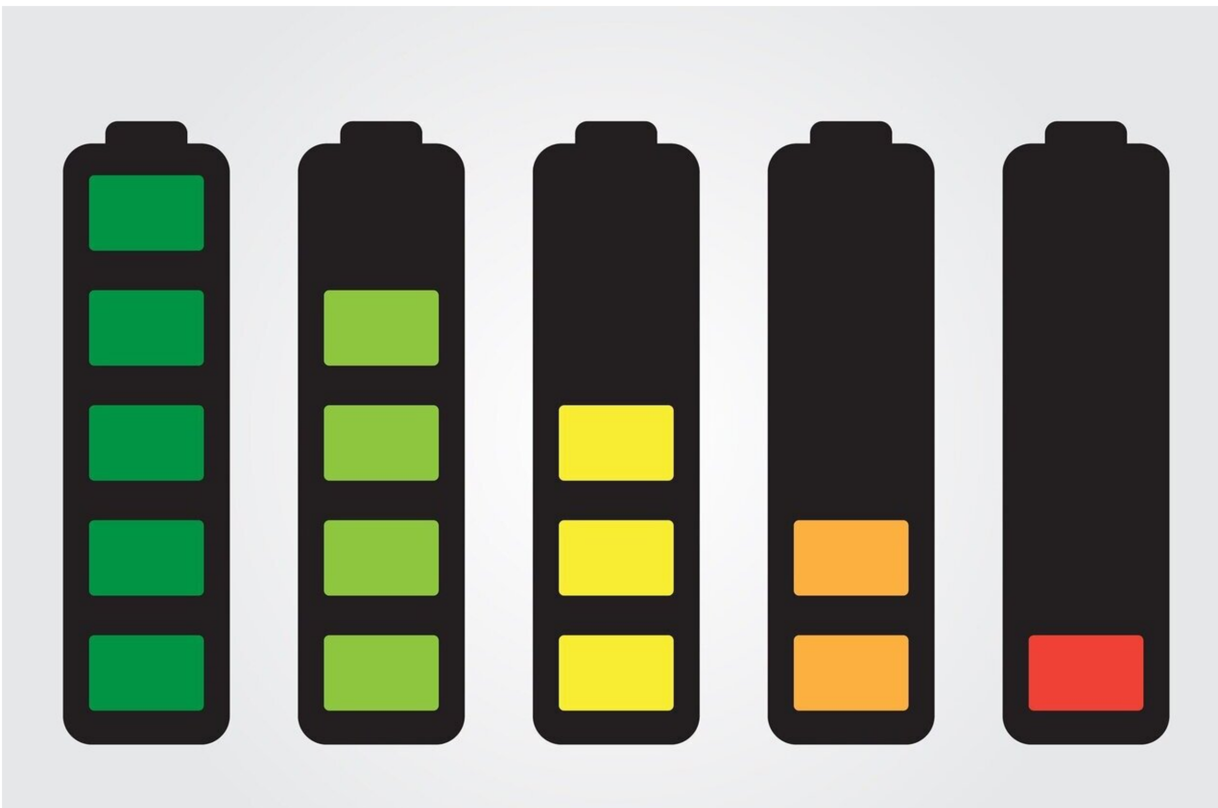

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Sodium-based dual-ion batteries (Na-DIBs) are promising for large-scale energy storage applications due to high efficiency, low cost, and environmental friendliness.

The large ionic radius of Na+ results in sluggish reaction kinetics and large volume changes of anode materials. Common design strategies are nanoscale modification and carbon-based composite construction. However, excessive carbon content will decrease the fraction of active material, and thus reduce the energy density of batteries.

Therefore, it is necessary to reduce the content of inactive carbon without compromising the conductivity of composite anodes, so that anodes can effectively deliver their specific capacities.

A research group led by Prof. Tang Yongbing from the Shenzhen Institutes of Advanced Technology (SIAT) of the Chinese Academy of Sciences, in collaboration with Dr. Pinit Kidkhunthod from Synchrotron Light Research Institute, Thailand, has proposed a molecular grafting strategy for one-step in-situ synthesization of a composite anode ($SnP_2O_7$@N-C) with ultrahigh-fraction active material for Na-DIBs.

The study was published in *National Science Review* on August 25.

The $SnP_2O_7$@N-C anode possessed an ultra-high fraction of active material of 95.6 wt%, the highest value among previously reported carbon-based composite anode materials.

The molecular grafting strategy enabled active nanodots to uniformly implant in the carbon matrix and effectively prevent the exfoliation of active materials, while the nitrogen doping contributed to high conductivity even at low carbon content.

The strategy endowed the $SnP_2O_7$@N-C anode with excellent Na+-ion storage performance, including high capacity of 400 mAh g-1 and excellent cycling stability of 1200 cycles.

Furthermore, this anode was paired with graphite cathode to yield a proof-of-concept Na-DIB, which showed a superior rate capability up to 30 C, good fast-charge/slow-discharge ability, and long-term cycling life with a capacity retention of ~96 % after 1000 cycles at 20 C.

**More information:** Sainan Mu et al. Molecular grafting towards high-fraction active nanodots implanted in N-doped carbon for sodium dual-ion batteries, *National Science Review* (2020). DOI: 10.1093/nsr/nwaa178

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