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Rational design of sandwiched polyaniline nanotube/layered graphene/polyaniline nanotube papers for high-volumetric supercapacitors

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Abstract

The adjustment and optimization of graphene-based electrode structures are crucial to achieve both high volumetric and gravimetric capacitances for portable energy storage devices. Structures of reduced graphene oxide (RGO)-polyaniline (PANI) nanotube hybrid electrodes were facilely regulated and rationally designed by *in-situ* MnO_2 nanowire-templated polymerization. Typically, two different architectures of RGO-PANI composites were obtained by controlling the content of MnO_2 nanowires in graphene papers. The assembled symmetric device based on the porous RGO-PANI nanotube papers (0.18 mg cm^{-2}, 20.0 μm), showed a high gravimetric specific capacitance of 956 F g^{-1} (against the mass of single electrode) at 1 A g^{-1} with excellent rate capability of 74.3% from 1 A g^{-1} to 10 A g^{-1}. In addition, another symmetric device based on the sandwiched polyaniline nanotube/layered graphene/polyaniline nanotube papers (0.80 mg cm^{-2}, 4.02 μm), provided an ultrahigh volumetric capacitance (722 F cm^{-3} at 2 A cm^{-3}) and a decent gravimetric capacitance

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