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Electrochemical properties of ternary rGO/CuS/PANI nanocomposite for supercapacitor electrodes

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Abstract: Although the metal-like electronic conductivity and high theoretical capacity of copper sulfide (CuS) makes it a promising material in supercapacitors, its poor cycling stability due to volume change during charge-discharge processes is a great challenge. To overcome this challenge, a novel 3D ternary nanocomposite of graphene-CuS-polyaniline (rGO/CuS/PANI) was designed and fabricated via in-situ hydrothermal polymerization methods. The structure and performances of the rGO/CuS/PANI-based electrode was characterized by powder X-ray diffraction, x-ray photoelectron spectra, scanning electron microscope, high-resolution transmission electron microscopy and Fourier transform infrared spectroscopy. Compared to the pristine CuS and rGO/CuS-based electrodes the rGO/CuS/PANI-based electrode showed better electrochemical properties that enhanced its capacitance. Specific capacitances of CuS, rGO/CuS and rGO/CuS/PANI-based electrodes are 93, 155, and 282.5 Fg-1, respectively, at a current density of 1 Ag-1. Moreover, cycling stability of the target electrode was also improved greatly with a retention ratio of 86 % after 1000 cycles. Such capacitance and cycling enhancements are due to the synergetic effects between the flower-like hollow structures of CuS and the excellent conductivities of rGO and PANI.

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