MnO_2 Nanowalls Grown on AgCNT-modified Carbon Fibers for High-Performance Supercapacitors

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Large-scale ultrathin γ-MnO_2 nanosheets form a continuous wall-like enclosed network directly grown onto the surface of carbon cloth (CC) fibers. In a simple green electrochemical deposition process, the CCs were pretreated under acid condition and subsequently attached by carbon nanotubes with silver nanoparticles (AgCNTs), forming a three-dimensional (3D) hierarchical heterostructure of MnO_2-decorated AgCNT CC fibers (MnO_2-AgCNT-CC). The structure, phase purity, and morphology of the samples were characterized by field emission scanning electron microscopy (FESEM), X-ray diffraction (XRD), Raman spectroscopy, X-ray photoelectron spectroscopy (XPS), and electrochemical techniques. The MnO_2-AgCNT-CC composite had high specific capacitance (up to 325 F/g at 1 A/g) and long cycle-life stability. These outstanding electrochemical characteristics were attributed to the unique 3D porous MnO_2 nanowalls and AgCNT composites, increasing ion-accessible surface area and shortening cation/electron transportation pathways, thus endowing the electrode with carbon fibers with good capability and long-term cycling stability, lucrative for large-scale energy storage applications. The simplicity of the developed fabrication process is appealing to the large-scale production of MnO_2-based materials on commercial CC fibers and for adaptation to roll-to-roll manufacturing through a continuous-fabrication process, widening its applicability.

