Multi-shelled bimetal V-doped Co3O4 hollow spheres derived from metal organic framework for high performance supercapacitors

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Abstract:

Using hollow structures containing more than one transition metal oxide seems to be essential to respond to the new generation of energy storage electrodes with remarkable performance for advanced expansions of new electronic devices. In this work, facile and controllable synthesis of multi-shelled V-doped Co3O4 hollow spheres derived from metal-organic framework through a solvothermal process followed by annealing as heat treatment has been studied. A comprehensive investigation of the hollow spheres in case of morphological, structural, and electrochemical behavior has been carried out. The multi-shelled V-doped Co3O4 (MS-V-CO) electrode displays well results, including electrochemical behavior (little internal resistance, fast kinetics, great reversibility, an excellent specific capacitance of 1593 F g−1), and structural features (high surface area (61.4 m2 g−1), multi shell structure, and wrinkled surface). An asymmetric supercapacitor (ASC) device has been assembled using multi shell vanadium doped cobalt oxide as the positive electrode (anode) and activated carbon (AC) as the negative electrode (cathode) and investigated for electrochemical performance. MS-V-CO//AC shows good behavior with a maximum energy density of 66.88 Wh kg−1 and power density of 240 Wkg−1 at 0.3 A g−1, relying on the total mass of active materials on both electrodes.

Keywords: Metal-organic framework, Metal oxide, Hollow spheres, Vanadium doped Co3O4, Multi-shelled