Construction of hierarchical nanoporous bimetallic copper-cobalt selenide hollow spheres

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Abstract

The search for novel materials with advanced electrochemical performance is attracted considerable attention, especially in portable energy storage devices. Metal selenides with high conductivity are attaining eminence as potential electrode materials in electrochemical energy-storage fields; nevertheless, their electrochemical performance is restricted by an insignificant active surface area. Thus, hollow structured materials with more active sites due to the improved surface area have attracted much attention for high-performance hybrid supercapacitors (HSC). Accordingly, for the first time, we successfully designed and synthesized hierarchical nanoporous hollow copper-cobalt selenide microspheres (CCSe) through a simple self-template procedure. The electrodes fabricated based on hollow CCSe material revealed outstanding electrochemical efficiency and great specific capacity of 562C g^{-1} at 2 A g^{-1} whereas excellent cycling stability according to preserving >94.5% of the initial capacity even after 5000 cycles. The asymmetric cell fabricated based on CCSe microspheres electrode with activated carbon (AC) anode electrode revealed ultrahigh performance with an energy density of 32.4 Wh kg^{-1}, the power density of 16 kW kg^{-1}, which are superior to those of conventional supercapacitors. In addition, two asymmetric systems assembled in series can efficiently light two red light-emitting diodes (LEDs). This study has introduced hollow CCSe as an ideal candidate for electrode materials of HSC apparatuses.

Keywords

Hollow spheres

Nanoporous

Hybrid supercapacitor

Transition metal selenide

Copper cobalt selenide