High Performance Asymmetric Supercapacitors Using Electrospun Copper Oxide Nanowires Anode

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Abstract

We have fabricated, for the first time, an asymmetric supercapacitor (ASC) employing pseudocapacitive copper oxide (CuO) as anode and electrochemical double layer capacitive commercial activated carbon (AC) as cathode. The CuO is in the form of nanowires of diameter ~30–50 nm developed using an aqueous polymeric solution based electrospinning process. The ASC showed larger voltage window ($V \sim 1.6$ V) and specific capacitance ($C_S \sim 83$ Fg^{-1}) than a control symmetric electrochemical double layer capacitor (EDLC) ($V \sim 1.4$ V; $C_S \sim 33$ Fg^{-1}) fabricated using the AC. The ASC delivered specific energy densities (E_S) of 29.5, 23.5, 19.2 and 16.4 W h kg^{-1} at specific power densities (P_S) 800, 1500, 4000 and 8400 W kg^{-1}, respectively. The performance of ASC is much superior to the control EDLC, which delivered E_S of 11, 10 and 8.8 W h kg^{-1} at P_S 800, 1600 and 3900 W kg^{-1}, respectively. Owing to the larger abundance of copper in the earth's crust and promising charge storage properties achieved herewith, the present ASC could be developed as a commercial electrical energy storage device.

Keywords: Electrochemical energy storage; Asymmetric supercapacitor; Renewable energy; Metal oxide semiconductors; Batteries; One-dimensional nanostructures

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