Asymmetric supercapacitor containing Carbon Nanotube-Embedded Polyacrylonitrile-based Carbon Nanofiber and δ-MnO_2 as Electrodes

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This investigation examines carbon nanotube (CNT)-embedded polyacrylonitrile-based carbon nanofibers (CNT/PAN-CNF) and δ-MnO_2 as electrodes for use in the asymmetric supercapacitor. The commercial CNT and the polyacrylonitrile precursor were mixed to fabricate CNT/PAN-CNF by the electrospinning method. Subsequently, CNT/PAN-CNF was treated by stabilization and activation. The δ-MnO_2 was prepared by hydrothermal reduction, which used $KMnO_4$ and $MnSO_4$ with molar ratio of 1:3 in 100 mL solution, at 140°C and 2 hours. The asymmetric supercapacitor using CNT/PAN-CNF and δ-MnO_2 could operate a high cell voltage of 2.0 V and a high reversible capacitance of 51.2 F/g, which shows the energy density of 57.3 Wh/kg. The energy density of asymmetric supercapacitor is much higher than that of symmetric supercapacitor by using δ-MnO_2 as electrodes (15.0 Wh/kg). Besides, the asymmetric supercapacitor shows the capacitance retention of 92% after 2000 cycles.

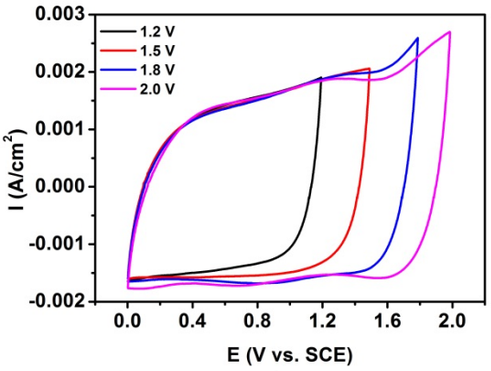

Figure 1. The CV curves of asymmetric supercapacitor using CNT/PAN-CNF and δ-MnO_2 operated at various potential windows. Scan rate: 5 mV/s.

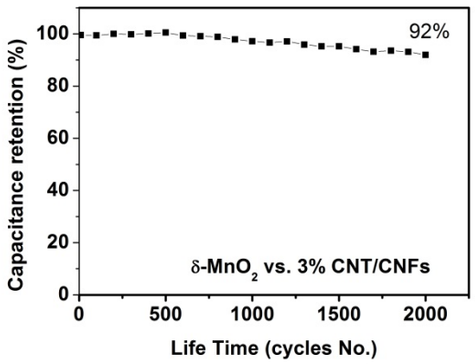

Figure 2. Capacitance retention of asymmetric supercapacitor using CNT/PAN-CNF and δ-MnO_2 operated. Cycling window: 2.0 V and scan rate: 50 mV/s.

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