Enhanced Energy Density of Supercapacitors Using Hybrid Electrodes Based on Fe₂O₃ and MnO₂ Nanoparticles

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A major limitation of transition metal oxide-based electrodes for supercapacitors is their low energy densities. Since the energy density is proportional to the specific capacitance and square of the operating voltage, extending the voltage window of the electrode as well as enhancing contacts with electrolyte is of utmost importance. In this paper, we focus on the hybrid electrode based on Fe₂O₃ and MnO₂ nanoparticles (NPs) which have different redox potential ranges, aiming for the increase of the specific capacitance and operating voltage window simultaneously. The hybrid Fe₂O₃/MnO₂ NPs-based electrode exhibited significantly improved energy density of 12.5 Wh/kg at a power density of 4500 W/g. The energy density of the hybrid electrode is 3.8 times and 1.3 times larger than that of the Fe₂O₃ and MnO₂ single electrode, respectively.

Keywords: supercapacitor, iron oxide, manganese oxide, nanoparticle, hybrid electrode.

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