Enabling High Performance Supercapattery Through Uniquely Designed Multilayer Oxides Electrode Material

Al-Qahtani , Tala (School: KFUPM Schools)

Modern wearable technologies require highly efficient energy storage devices to improve their performance while maintaining low cost and non-toxicity. One of the most salient devices that possess promising energy values is called a supercapattery. In this work, a successful fabrication of a supercapattery using the thermal evaporation technique for the first time has been demonstrated that exhibits high capacitance, high power density and high energy density. Cost-effective, non-toxic and abundantly available materials, such as activated carbon, MnO2 and V2O5 were used to design the electrodes in a unique way that consists of a layered structure of the metal oxides. The performance of the fabricated supercapattery was investigated through multiple electrochemical characterization instruments including CV, GCD and EIS, that were repeated 3 times. On average, the maximum specific capacitance of the supercapattery was calculated to be 183F/g from the cyclic voltammetry. The device exhibited ultra-high energy density of 101.9Wh/kg, which is much larger than the energy density of the regular supercapacitors having 10-30Wh/kg. The electrochemical features including specific capacitance and energy density of the fabricated device are promising and superior to many recently published reports. The device also demonstrated actual applications, including lighting an LED and rotating the propeller fixed on a DC motor. This fabricated device has great potential to be used in electronic equipment and hybrid cars to develop a sustainable future and pollution-free environment.