High Voltage, Flexible PPy/MnO_2 Asymmetric Solid-State Supercapacitors Device

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Abstract

Flexible supercapacitors have shown great potential in portable and wearable electronics. However, low energy density limit the practical application of flexible supercapacitors devices. This study presents a simple and low-cost method to prepare a binary complex electrode. Polypyrrole/Mn oxide/carbon cloth (PPy/MnO_2/CC) as positive electrode, PPy combined with MnO_2 can improve the shortcomings of PPy low capacitance and MnO_2 low electrical conductivity. MnO2/carbon cloth (MnO_2/CC) was selected as negative electrode, and a low cost eco-friendly PVA-$LiClO_4$-urea was selected as solid-state electrolyte. Asymmetric PPy/MnO_2//MnO_2 devices tests in solid state electrolyte exhibit a wide potential window of 2.1 V, replace conventional aqueous electrolytes (with a theoretical decomposition voltage of 1.3 V) and improve a large energy density of up to 118 Wh/kg at 0.5 A/g and power density 5.25 kW/kg as well as excellent rate capability (capacitance retention of 92 % after 3000 cycling test), including bending and twisting. Finally, we using sandwich-type design of high voltage, wearable asymmetric supercapacitors device based on solid-state electrolyte taking account also of the outstanding electrochemical flexibly, stability, non-flammability and safely attached to user's bodies of the device. These results open a new route for the development of wearable and self-powered devices.

Keywords - Wearable Supercapacitor 、Solid state electrolyte 、MnO_2 、Ionic liquid