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A high performance flexible solid-state asymmetric supercapacitor based on composite of reduced graphene oxide@dysprosium sulfide nanosheets and manganese oxide nanospheres

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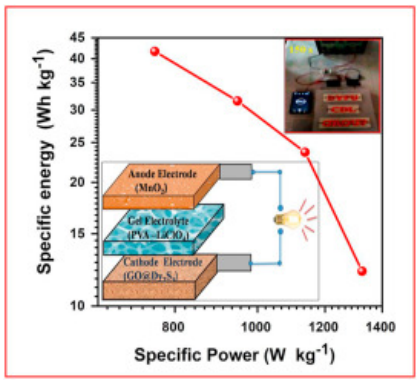
Abstract

The reduced graphene oxide@dysprosium sulfide (rGO@Dy_2S_3) composite and MnO_2 films are synthesized using successive ionic layer adsorption and reaction and from chemical bath deposition methods, respectively. Addition of rGO in Dy_2S_3 film enhances specific surface area from 40 to 78 m^2g^{-1}. Using these films flexible solid-state symmetric; rGO@Dy_2S_3//Dy_2S_3@rGO and asymmetric; MnO_2//Dy_2S_3@rGO supercapacitor devices are fabricated. The solid-state asymmetric supercapacitor device exhibits specific energy of 41 Wh kg^{-1} at specific power 1330 W kg^{-1}. The stability of asymmetric supercapacitor is 86% after 5000 cycles and flexibility of 82% at the bending angle 165°. This work highlights the first time use of rGO@Dy_2S_3 composite thin film material to fabricate symmetric and asymmetric supercapacitor devices and also demonstrates the superior performance of asymmetric device than symmetric one.

Graphical abstract



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