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Binder free lanthanum doped manganese oxide @ graphene oxide composite as high energy density electrode material for flexible symmetric solid state supercapacitor

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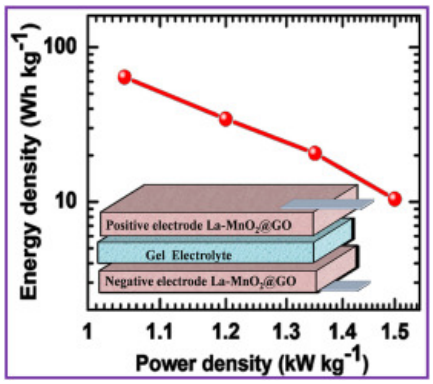
Abstract

The present work is about synthesis of La doped (1–5 vol %) manganese oxide (MnO_2) @ graphene oxide (GO) composite electrode. The thin films are obtained using a facile and binder free successive ionic layer adsorption and reaction (SILAR) method. The scanning electron microscopic image of 3%La–MnO_2@GO composite thin film shows porous spongy-like nanoparticles. Nitrogen desorption analysis shows that mesoporous sheets of 3%La–MnO_2@GO exhibits large surface area up to 149 m^2g^{-1}. The highest electrochemical specific capacitance of 729 Fg^{-1} at the scan rate of 5 mVs^{-1} is obtained for 3%La–MnO_2@GO electrode. The 3%La–MnO_2@GO thin film electrode exhibits 94% capacitive retention over 5000 CV cycles. The flexible symmetric solid state supercapacitor device of configuration SS/3%La–MnO_2@GO/PVA-Na_2SO_4/3%La–MnO_2@GO/SS operating in potential window 1.8 V shows maximum specific capacitance of 140 Fg^{-1} with energy density of 64 Wh kg^{-1} at power density of 1 kW kg^{-1} and capacitive retention of 90% after 5000 CV cycles at the scan rate of 100 mVs^{-1}.

Graphical abstract



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