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Supercapacitor devices based as SILAR synthesized ytterbium sulfide @ graphene oxide nanocomposite flexible thin film electrodes

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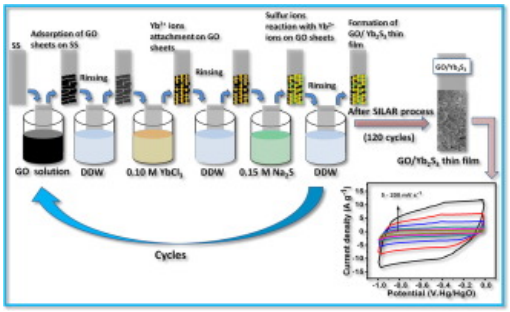
Abstract

Ytterbium sulfide (Yb_2S_3), graphene oxide (GO), and graphene oxide/ytterbium sulfide (GO/Yb_2S_3) composite thin films were synthesized by binder-free successive ionic layer adsorption and reaction (SILAR) method. Formation of Yb_2S_3, GO and GO/Yb_2S_3 composite thin films was confirmed by XRD and XPS techniques. Surface morphology and particle size of these films were observed through FE-SEM and TEM analyses. All thin films showed hydrophilic nature. The Yb_2S_3, GO and GO/Yb_2S_3 composite thin films exhibited the maximum specific capacitance of 181, 193 and 376 F g^{-1}, respectively in 1 M Na_2SO_4 electrolyte at scan rate of 5 mV s^{-1}. The flexible solid state supercapacitor (FSS-SSC) symmetric device was fabricated with GO/Yb_2S_3 composite electrodes as an anode and a cathode and a flexible solid state asymmetric supercapacitor (FSS-ASC) device were fabricated with GO/Yb_2S_3 as an anode and MnO_2 as a cathode electrode with the PVA-Na_2SO_4 gel electrolyte. The FSS-SSC device showed specific capacitance 58 Fg^{-1}, energy density 23 Wh kg^{-1} and power density 0.43 kW kg^{-1}. The FSS-ASC device showed specific capacitance 92 Fg^{-1}, energy density 42 Wh kg^{-1} and power density 0.84 kW kg^{-1}. Both FSS-SSC and FSS-ASC devices showed coulombic efficiency of 88 and 79% for 10,000 GCD cycles, respectively. The FSS-ASC device showed better performance than the FSS-SSC device. The FSS-ASC device showed better performance than the FSS-SSC device.

Graphical abstract



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