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SILAR synthesized dysprosium selenide (Dy_2Se_3) thin films for hybrid electrochemical capacitors

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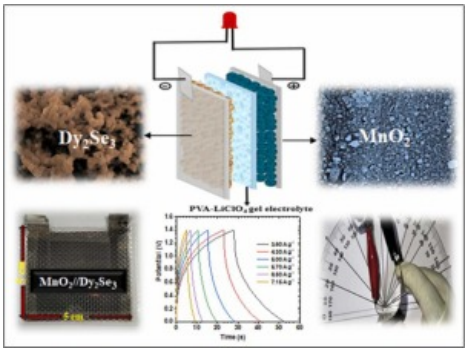
Abstract

As the necessity of energy storage is continuously increasing, new materials have been investigated for electrochemical energy storage, especially for electrochemical capacitors. These storage devices are rapidly convertible as well as air pollution free. Therefore, a number of materials have been explored as electrode materials for supercapacitors to fulfill different requirements of electrochemical energy storage. Herewith, dysprosium selenide (Dy_2Se_3) films were prepared using the simple successive ionic layer adsorption and reaction (SILAR) method and characterized using different physico-chemical techniques. The specific capacitance (C_s) of $92\,Fg^{-1}$ was obtained at the current density of $2.85\,Ag^{-1}$ in 1 M $LiClO_4$ electrolyte with a retention of 85% over 5000 galvanostatic charge-discharge (GCD) cycles performed at a current density of $4\,Ag^{-1}$. The flexible solid-state hybrid electrochemical capacitor of configuration $Dy_2Se_3/LiClO_4$-PVA/MnO_2 showed C_s of $83\,Fg^{-1}$ and specific energy of $18\,Whkg^{-1}$ at a specific power of $2.7\,kWkg^{-1}$. This hybrid device retained 92% of capacitance at a device bending angle of 160°. These results demonstrate the facile synthesis of Dy_2Se_3 and its possible use in electrochemical energy storage applications.

Graphical Abstract



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Introduction