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Electrophoretically Deposited Graphene Oxide and Carbon Nanotube Composite for Supercapacitors

An electrochemical supercapacitor is an energy storage device that offers significant advantages over current energy storage systems. These advantages include rapid charge/discharge rate, lower mass-to-weight ratio, environmental friendliness, and a potentially limitless life cycle without maintenance. Reduced graphene oxide (rGO) is a high specific surface-area electrode material that, when complemented with multi-walled carbon nanotubes (MWCNT), promises a high energy density surpassing those of state-of the art batteries. The objective of this research is to develop an electric double layer capacitor (EDLC) using novel electrode materials deposited on conductive, semi-conductive, and flexible substrates. The rGO was created via modified Hummer's method. A hybrid rGO-MWCNT composite solution was prepared and deposited using modified electrophoretic deposition (mEPD). The mEPD process was studied to control the electrode thickness and determine an optimal surface area. The chemical composition was characterized with Fourier transform infrared spectroscopy and Raman spectroscopy. The electrode morphology was imaged using scanning electron microscopy (SEM) and atomic force microscopy (AFM). The electrical properties of specific capacitance and sheet resistance were characterized using electrochemical measurements and the Van der Pauw method respectively.