Electron beam irradiation of reduced graphene oxide-palladium nanocomposite for electrochemical supercapacitor

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Recent work has shown that palladium nanoparticle–graphene composite can be an efficient electrode material in energy storage applications in supercapacitors. These Pd-based supercapacitors showed remarkable properties with a maximum specific capacitance of 637 F g^{-1} and also exhibited excellent cycle life with 91.4% of the initial specific capacitance retained after 10000 cycles. Palladium nanoparticle decorated graphene composite was synthesized via a chemical approach in a single step by the simultaneous reduction of graphene oxide and palladium chloride from the aqueous phase using ascorbic acid as reducing agent. In the present work, electron beam irradiation has been investigated as an attempt to produce graphene-palladium nanocomposites. Graphite oxide was prepared using a modified Hummers' method and dispersed in ethanol, exfoliated using ultrasonication to produce Graphene Oxide (GO) and dried for further analysis and processing. This material was thermic reduced in high vacuum (10^{-6} mbar) at various temperatures (200-600°C) and mixed in a solution with palladium. The samples were placed in a 50 ml beaker with $Pd(NO_2)_2$ $2H_2O$ and were irradiated with 300kGy , dose rate 1,6 kGy s^{-1}. Irradiation was carried out in an electron accelerator Dynamitron de 37,5 kW (E = 1,5 MeV, 25 mA) (Radiation Dynamics Inc.), The resulting irradiated material was characterized by X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR). These investigations showed that a palladium graphene mixture for supercapacitors applications is formed by electron beam irradiation.

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