Hybrid polyoxometalate/reduced graphene oxide composites for supercapacitors.

Jullieth Suarez-Guevara\textsuperscript{a}, Vanesa Ruiz\textsuperscript{a,b} Pedro Gomez-Romero\textsuperscript{a,*}

\textsuperscript{a} Institut Català de Nanociència i Nanotecnologia, ICN2-CSIC-UAB Campus 08193 Bellaterra, Spain.
Phone: +34 937373608

\textsuperscript{b} Present Address: European Commission, DG Joint Research Centre, Institute for Energy and Transport, P.O. Box 2, 1755 ZG Petten, The Netherlands

*pedro.gomez@cin2.es, jullieth.suarez@gmail.com, vanesarz79@gmail.com

Abstract

In this work, we present the novel synthesis and electrochemical study of polyoxometalate-graphene oxide hybrid materials to be used as electrode in Supercapacitors (SCs). The synthesis involves the reduction of graphene oxide (GO) with simultaneous incorporation of polyoxometalate (POM).\textsuperscript{1} The existence of the strong chemisorption between polyoxometalate and graphene oxide makes it possible to construct stable hybrid carbon structures.

Hybrid materials were carried out in a single step by means of a hydrothermal treatment (120 °C, 24 h) of an aqueous solution of polyoxometalate: H\textsubscript{3}PMo\textsubscript{12}O\textsubscript{40}.10H\textsubscript{2}O (PMo\textsubscript{12}) and exfoliated graphene oxide (GO). The resulting materials (labeled HT-RGO-PMo\textsubscript{12}) was filtered-off, washed and dried at 50 °C overnight. The amount of POM impregnated was determined by TGA. A similar treatment of a GO sample without POM added was carried out for comparison (sample HT-RGO).

Figure 1 shows the HR-TEM images of the blank HT-RGO sample (Fig. 1A) and HT-RGO-PMo\textsubscript{12} (Fig. 1B). The presences of the inorganic POM clusters on the surface graphene are clearly detected in the latter image, and are evenly distributed at a truly molecular level and no agglomerate or nanocrystal could be detected.

The electrochemical characterization of the hybrid materials was tested by cyclic voltammetry and galvanostatic charge-discharge test in two- and three- electrodes configurations, where platinum wire and Ag|AgCl were used as counter and reference electrode, respectively. 1 M H\textsubscript{2}SO\textsubscript{4} was the electrolyte.

References


Figures

Figure 1. - HR-TEM images of HT-RGO (A) and HT-RGO-PMo12 (B). Scale bars are 10 nm.