Processing of Graphene Oxide – Carbon Nanotubes Hybrids for Supercapacitor Electrodes

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Abstract

Graphene oxide (GO) is currently the most prominent precursor for mass production of graphene towards feasible industrial applications. GO has a lot of potential due to its large area of functional groups, mechanical strength, low-cost synthesis and simply processing into freestanding electrodes [1]. However GO is actually a non-conducting material, thus additives or partial chemical-thermal reduction is needed to achieve reliable electrochemical sensing and robust energy storage materials.

Lately, it was assumed that mixture of carbon nanotubes (CNT) and graphene materials leads to synergism for enhanced electrochemical hybrids, which may open a wide range of nanomaterial architectures with superior performance [2,3]. However, wisely control of nanostructure assembly during processing seems to be key to improve its electrochemical properties.

In this work, pure GO and CNT membranes along with three routes of fabrication of buckypapers hybrids (GOBucky) were obtained by vacuum assisted filtration using different dispersion treatments: All samples were structural and physico-chemical extensively characterized by TEM, FESEM, XRD, Raman, XPS, TGA, and BET, Fig. 1.

Thickness, GO to CNT ratio, and gentle temperature reduction treatment are critical parameters to achieve higher specific capacitance. Direct correlation between electrochemical performance (Fig. 2) and type of processing applied was found, which could increase up to one order of magnitude higher after partial reduction treatment. Finally, hybrids' charge storage improvement is explained taking into account nanostructure assembly, dispersion stability, specific superficial area and conductivity for each type of processing route.

References

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Figures

Fig. 1. Buckypapers hybrids (GOBucky) obtained by vacuum assisted filtration using different dispersion treatments.

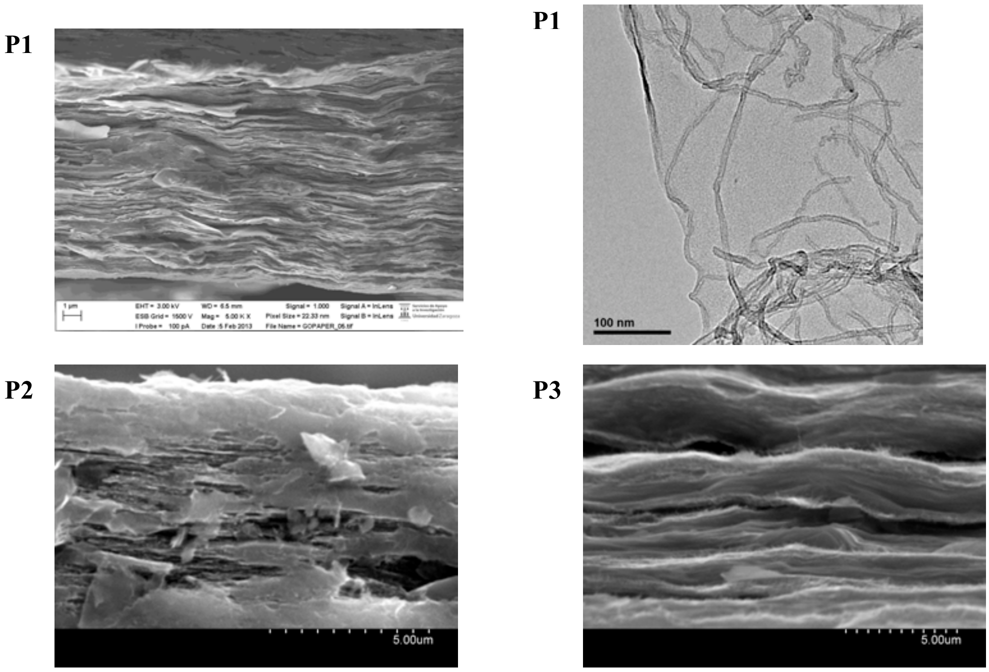
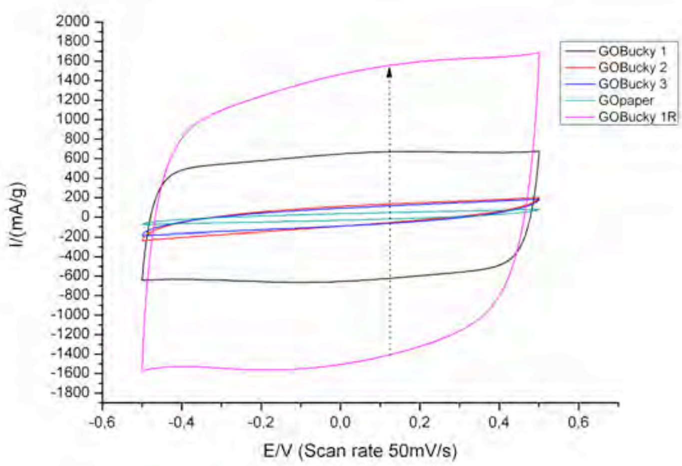


Fig. 2



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