GRAPHENE AEROGEL WITH UNIDIRECTIONAL PORES OF TAILORED SIZE AND ITS APPLICATION AS HYDROPHOBIC ABSORBENT AND AS SUPPORT FOR CATALYTICALLY ACTIVE NANODIAMONDS

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It is of fundamental and practical significance to translate the novel physical and chemical properties of individual graphene nanosheets into the macroscale by the assembly of graphene building blocks into macroscopic architectures with control over the porous structure and functionalities. 3D graphene aerogels have some interesting properties such as high specific surface area, open porous network for ion transport, supra-flexibility, tough mechanical strength and conductive framework which lend them high potential for wide application fields such as supercapacitors, oil-water separations, sorbents, chemical reactor platforms and solar cells.[1-2] One way to prepare 3D aerogels is starting from GO sols and its gelation under hydrothermal conditions [2]. The functional groups of GO nanosheets are removed by reduction resulting in a decrease of hydrophilicity and loss of surface charges, which leads to the crosslinking of RGO nanosheets and ultimate phase separation. Herein, we have varied the hydrothermal synthesis conditions (pH, time, and freezing method) to achieve a control over the pore orientation and size of graphene aerogels. The mechanical properties of the aerogels varied from more rigid to flexible materials. In addition, we have been able to synthetize graphene aerogels with aligned channels resembling honeycomb structures (Figure 1). As a proof of concept, the materials have been tested as hydrophobic absorbents of organic compound and as support for nanodiamonds (Figure 2). The nanodiamonds supported on graphene aerogels have been tested for the selective dehydrogenation of propane providing an excellent performance.

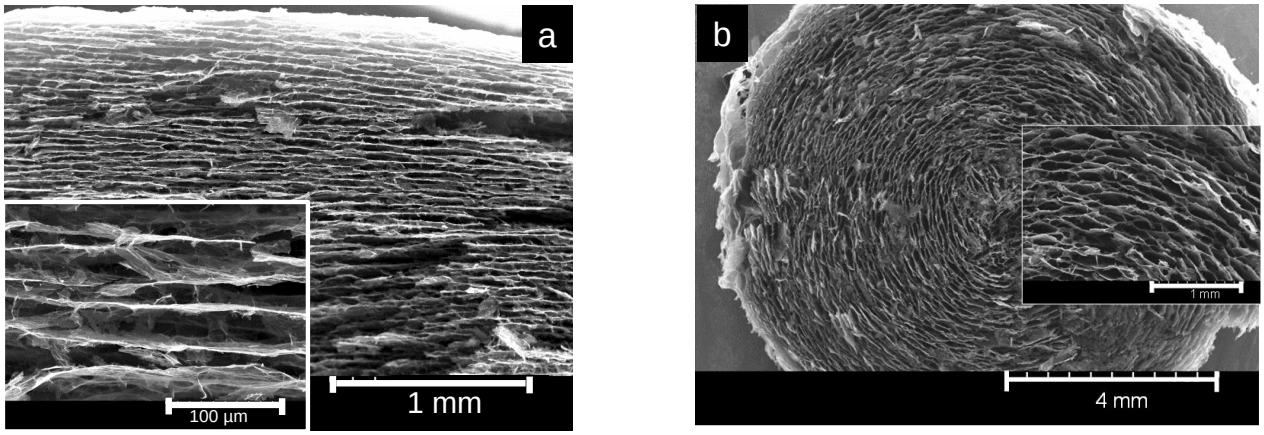

Figure 1. – Graphene aerogel with unidireccional pores: (a) longitudinal cut; (b) cross-section

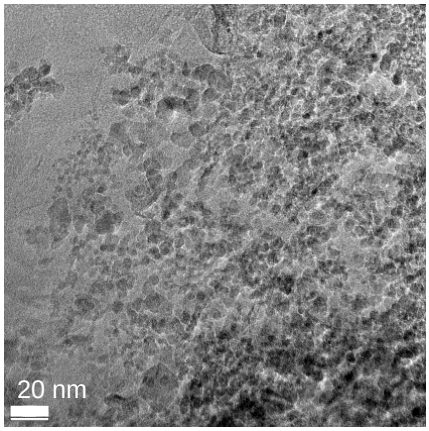

Figure 2 – Nanodiamonds supported on graphene aerogel nanosheet

References

[1] Chabot, V.; Higgins, D.; Yu, A.; Xiao, X.; Chen, Z.; Zhang, J., Ener. Environ. Sci., 7 (2014) 1564.

[2] Roldan, L.; Benito, A. ; Garcia-Bordeje, E., J. Mater. Chem. A, 3 (2015) 24379

Aknowlegement

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