Graphene aerogel formation under hydrothermal conditions and application as adsorbent for organic removal

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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 of 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.

However, the understanding of the assembly process and structure control of 3D GA is still inadequate.

Herein, we have studied the effect of the pH of solution and time of gelation on the properties of the resulting aerogels. To this end, we have characterised the porous texture and surface chemistry of the aerogels by SEM, N_2 physisorption, UV-vis spectrophotometry, IR spectroscopy and temperature programmed desorption.

Finally, the materials prepared under different pHs and times have been tested in the absorption of several organic substances. The preparation conditions affected the porosity, surface chemistry and the adsorption of the organic pollutant. The aerogels are able to adsorb up to 120 times its weight of organic substance due to its light weight, high open porosity and hydrophobicity. This property makes them excellent candidates to adsorb spills of organics in water.

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

Figures

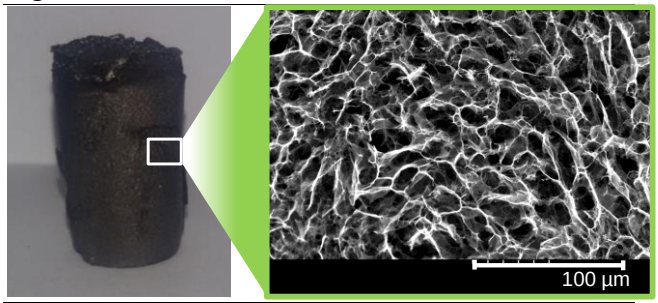

Figure 1: Photography of aerogel and SEM image of the interior

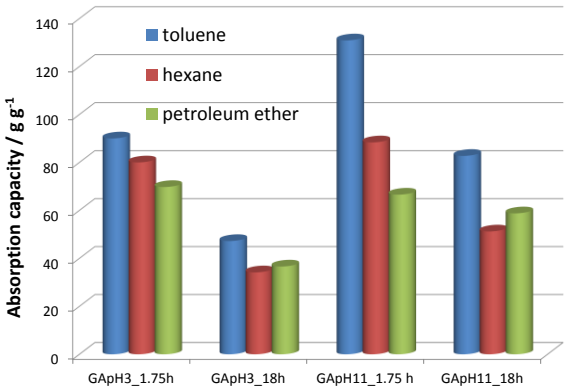

Figure 2: Adsorption capacity of several organic substances