Modulating the degree of structural ordering of carbon gels

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Synthetic carbons with very well controlled porous structure were obtained from polymerization of resorcinol and formaldehyde. Varying the synthesis conditions, mainly amount of precursors and pH of the precursor solution, carbons with different textural properties are obtained. The synthesis conditions lead to a three dimensional network of interconnected nodules. The size of the nodules and the crosslinking degree determine the mean pore size of the resultant carbon in the meso or macropore range. These materials present an amorphous structure, but the degree of ordering may be modified by (i) adding some additives to the precursor solution prior synthesis, (ii) high temperature post-treatment of the carbons or (iii) a combination of both approaches. In this work, carbon gels with tailored pore diameter from 10 to 3000 nm were produced. The evaluation of high temperature treatments on their ordering degree was performed, and a great influence of the nodule size on graphitization was detected. On the other hand, graphene oxide was incorporated to the precursor solution of the carbon gels and an increase of the ordering with that addition was also detected. However, the highest ordering degree was obtained by treatment at high temperature of the hybrid graphene-carbon gel, where the graphene imbibed in the carbon structure acted as a seed during the graphitization process.