Lamellar-shaped carbon-graphene composites as electrodes for high energy supercapacitors

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Herein, we show a facile procedure for the preparation of phosphate-functionalized carbonaceous graphene-based composites as electrodes for high energy supercapacitors. The synthesis involves: i) the deposition of a thin layer of phenolic resin on the surface of graphene oxide (GO) sheets using phosphoric acid as polymerization catalyst and functionalization agent and ii) subsequent pyrolysis of the resulting composites. Homogeneous lamellar-shaped porous carbon-graphene composites with excellent properties for supercapacitor applications, such as enhanced molecular diffusion and high electronic transfer [1], were obtained. The graphene-free sample and the KOH-activated composite were also prepared to full understanding the role of graphene sheets and the porous properties on the supercapacitor performance. The three materials were tested as electrodes for supercapacitors in combination with the aqueous electrolyte 1M H_2SO_4. It was found that the presence of GO and the KOH activation lead to an enlargement of the specific surface area and a progressive widening of the micropores. Hence, the specific capacitance and the capacitance retention are boosted from the graphene-free sample to the KOH-activated composite. Moreover, the presence of phosphorous allows opening the voltage window to values above the theoretical decomposition of water (1.2V) [2,3], resulting in a considerable increment of the energy density and power delivery of the cell.

References

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Figures

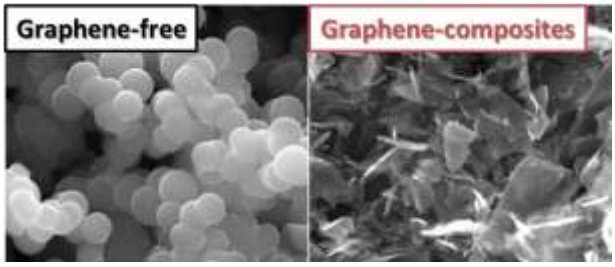

Figure 1: SEM images of graphene-free and graphene-composites

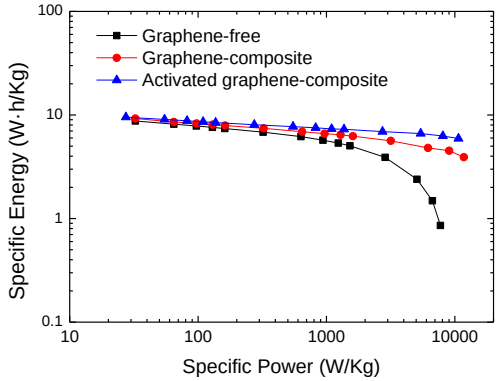

Figure 2: Ragone plot of graphene-free, graphene-composite and activated graphene-composite in the aqueous electrolyte 1M H_2SO_4