Hybrid 3D graphene materials for energy applications

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Three-dimensional graphene based materials are of great interest as they combine the intrinsic properties of graphene, with high specific surface area and low density. In this work we present a novel, simple and versatile method to synthesize materials based on 3D graphene with supported metal oxide nanoparticles (3D-rGO/MOx) by a hydrothermal process. The synthesis process combines the growth of metal oxides nanoparticles and the reduction of GO in one single step, followed by a freeze drying treatment.

The obtained 3D-rGO/MOx materials exhibit inherent properties like a microporous/ mesoporous structure of graphene sheets with homogenous dispersion of MOx nanoparticles, large surface area and large pore size distribution. It allows easier access and fast transport of the electrolyte solution to the adsorption sites, high specific capacitance, high electrical conductivity; and superior electrochemical stability comparing with other carbonaceous materials such as activated carbons.

As a prove of the versatility of this 3D-rGO/MOx material, we present the preparation of electrodes for water deionization and cathodes for lithium-sulfur batteries [1].

References

[1] *Huajie Yin, Shenlong Zhao, Jiawei Wan, Hongjie Tang, Lin Chang, Liangcan He, Huijun Zhao, Yan Gao and Zhiyong Tang*, *Adv. Mater.*, (2013)

Figures

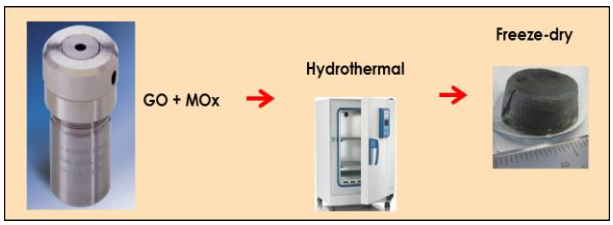

Figure 1: Hydrothermal method to synthesize 3D-rGO/MOx materials

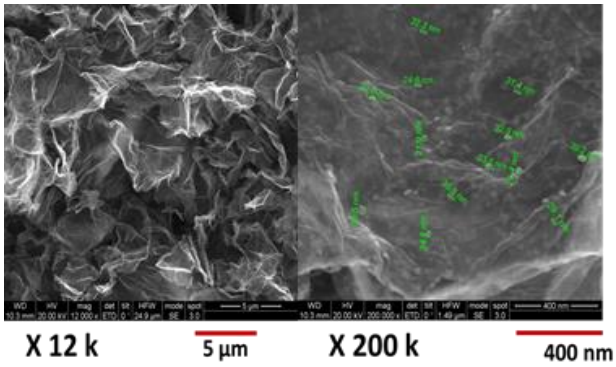

Figure 2: SEM images of 3D-rGO/Fe_2O_3

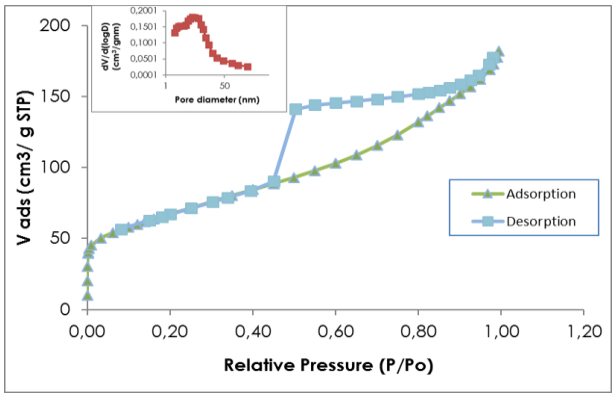

Figure 3: N_2 adsorption-desorption isotherms and pore size distribution (inset) of 3D-rGO/Fe_2O_3