Surface Modification of Graphene-Metal Oxides by Microwave Irradiation for Applications in Supercapacitors

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Flexible free-standing lightweight films formed with graphene and graphene oxide hold great promise for applications in energy storage devices like supercapacitors and batteries with high specific power and energy density.[1]

For further improvement of the performance of energy storage devices, various graphene based metal oxide hybrids also can be used as a superior material for flexible electrodes. A plenty of nanostructures containing graphene oxide and metal oxide nano-particles in the form of anchored, wrapped, encapsulated, layered, sandwich and mixed structures prepared using different metals by microwave irradiation (MI) can be elaborated using this versatile method[2], very useful for rapid synthesis with minimum requirements of power and energy. From the point of view of nano-structures formation, metal oxide structures are mechanically confined by graphene oxide, and this not only suppresses the agglomeration and re-stacking of graphene nanosheets (Figure 1) but also increases the surface area of the graphene oxide (Figure 2). These morphologies lead to enhanced electrochemical activity and play the main role in applications looking for efficient energy storage in supercapacitors. Here we report the syntheses of various graphene-based metal oxide hybrids for enhanced capacitance that originates from increased electron transport, protected restacking of graphene sheets, high surface area, and efficient electrolyte pathways. In addition, new arrangements in manufacturing of micro supercapacitors[1] using these hybrid materials are in progress.

References:

[1]Kumar, R.; Savu, R.; Joanni, E.; Vaz, A. R.; Canesqui, M. A.; Singh, R. K.; Timm, R. A.; Kubota, L. T.; Moshkalev, S. A., *RSC Adv.*, ***6*** (88), 84769 (2016)
[2]Kumar, R.; Singh, R. K.; Vaz A. R..; Moshkalev, S. A., R*SC Adv.* , ***5***, 67988 (2015)

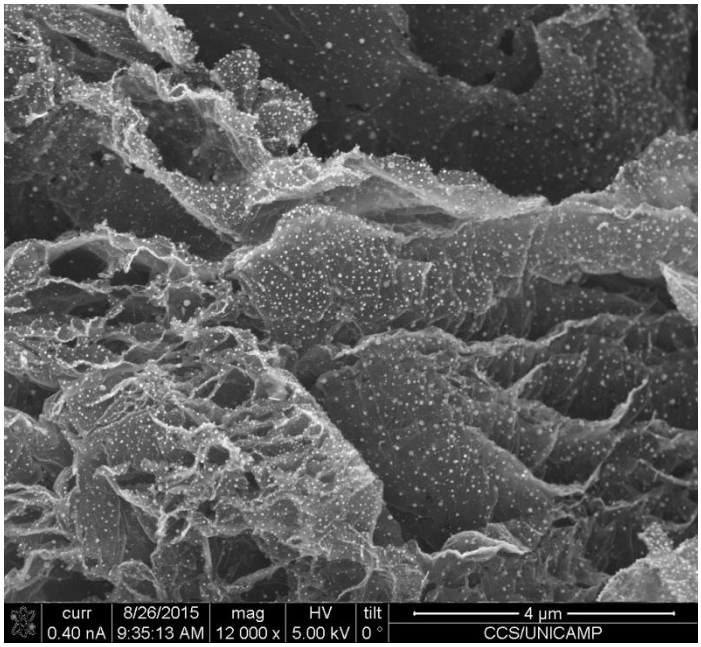

Figure 1: Graphene oxide nanosheets containing Co and Ni nanoparticles synthesized by microwave irradiation.

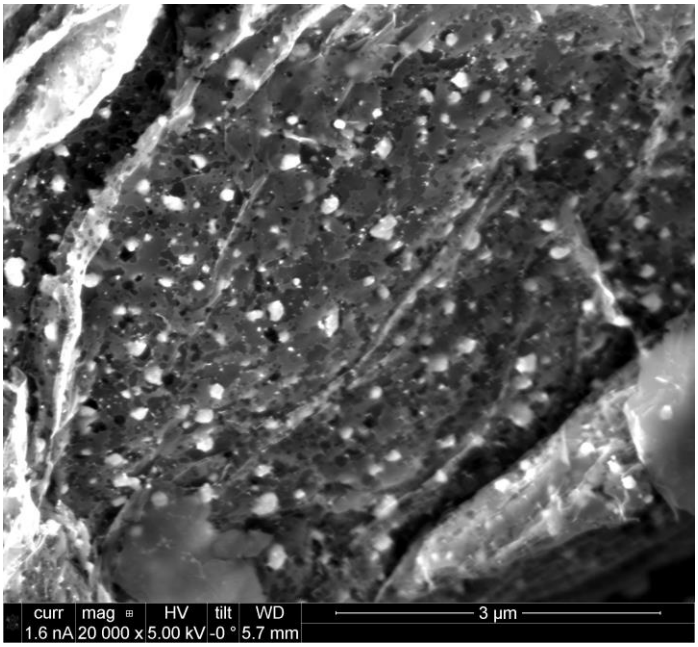

Figure 2: Graphene oxide nanosheets containing Pd nanoparticles synthesized by microwave irradiation.