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Plasma in liquid processing of nanomaterials dispersion

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Functionalization of nanomaterials has large interest in various fields such as engineering, chemistry, biology, medicine, pharmaceutical and cosmetic industries. For nanomaterials in powdered form the easiest way to functionalize is in liquid phase, thus avoiding difficulties related to agglomeration. By applying existing procedures based on chemical treatments that use strong acids, different solvents, surfactants and polymers, etc., the resulting product retains some degree of contamination. Submerged in liquid plasma treatment is a new approach for nanomaterials functionalization, a method that has proven excellent results in the case of nanotubes and graphene dispersions, leading in modification of the initial nanomaterials characteristic like their solubility, dispensability, electrical and specific capacitance properties.

In this study, we used an atmospheric pressure plasma jet source [1] that work also under liquid submersion. Mixtures of Ar/O₂ and Ar/N₂ were used for various gas flow rate, RF power and treatment time in graphene based dispersion. The modifications in the liquid phase were characterized in terms of UV-Vis absorption, zeta-size, zeta-potential, pH, and conductivity. The obtained nanomaterials after suspensions evaporation were investigated by SEM, TEM, FTIR, XPS and Raman spectroscopy [2].

The results demonstrate the efficiency of this technique in changing the properties of the nanomaterials dispersion and also in getting functionalized multilayered graphene sheets with various chemical groups.

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