The exfoliation of graphene in liquids by electrochemical, chemical and sonication-assisted techniques: a nano-scale study

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While graphene can already be produced with high quality on small scale, massive production on ton scale will be needed to allow good processability and low costs applications in composites, batteries, inks, etc. Nature has provided us with large amounts of high-quality graphene sheets, stacked inside mineral graphite; all we need to find is a convenient way to efficiently exfoliate it into single sheets, preserving its nice conjugated honeycomb structure. The commonly accepted rational about graphene exfoliation is that the more defects are introduced in the lattice, the more soluble are the sheets, the more efficient is the exfoliation. However, the exfoliation itself is a complex process acting at nano-, meso- and micro-scale, and the use of organic molecules or electric fields can trigger the exfoliation process yielding stable solutions in water or other solvents. In this talk we compare some of the most common techniques used for graphene production in solution. To this aim, we use an original approach and analyse not only the graphene successfully dispersed, but focus as well our attention on the graphite that is left behind after the exfoliation process. In this way, the surface exfoliation process can be easily followed by optical microscopy (OM), atomic force microscopy (AFM) and scanning electron microscopy (SEM). X-rays diffraction (XRD) and Raman spectroscopy are also used to monitor substrate damage on atomic scale, and the effectiveness of the exfoliation process.

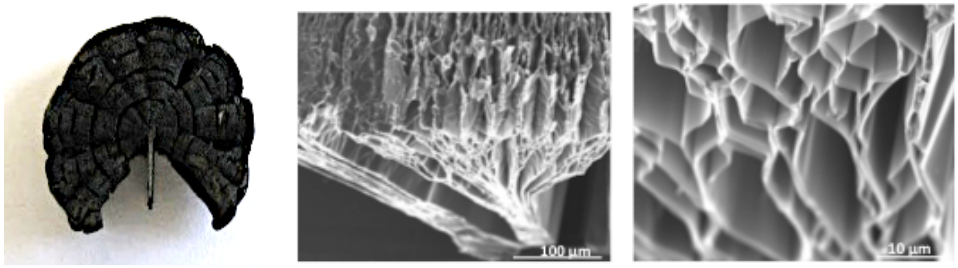

Fig. 1 Images of graphite exfoliation on different scales.

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