Graphenofluids produced by hydrodynamic cavitation 'on a chip'

A. Mohanty
S. Ponomareva, F. Ayela
Laboratoire des Ecoulements Géophysiques et Industriels - GGG, Université Grenoble Alpes, C.N.R.S., 1209 rue de la Piscine, 38610 Gières, France.
frederic.ayela@legi.cnrs.fr

The Grenoble Green Graphenofluid project (GGG) is funded on the liquid phase exfoliation of graphitic microparticles by the use of hydrodynamic cavitation inside microchannels [1]. That innovative and patented process produces graphene nanosheets whose thickness runs from 1 to 10 carbon layers, with an average 150 – 300 nm lateral size (figure 1). Low hydraulic power is required, so that the low-cost mobile experimental facility is able to produce graphene nanosheets on demand, under the best possible conditions of safety. The graphenofluids are delivered in an aqueous solution with surfactant, at a concentration around 1g/L. Surfactant is partially removed when films a few micrometers thick are performed by vacuum filtration (figure 2). To overcome the inherent limitations caused by the surfactant, we are currently developing an exfoliation process with Cyrene™ as a bio sourced solvent, whose surface energy is matching the surface energy of graphene, but whose viscosity is 14 times higher than the viscosity of water.

References

[1] X. QIU, W. CHERIEF, D. COLOMBET and F. AYELA, J. Micromech. Microeng. 27(4), (2017) 047001

[2] X. QIU, V. BOUCHIAT, D. COLOMBET and F. AYELA, RSC Adv. 9, (2019) 3232-3238

Figures

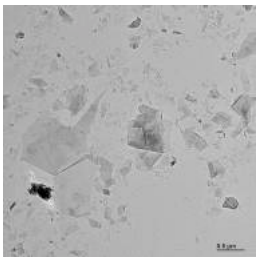

Figure 1: TEM observation of graphene nanosheets produced by GGG. The scale bar is 500 nm.

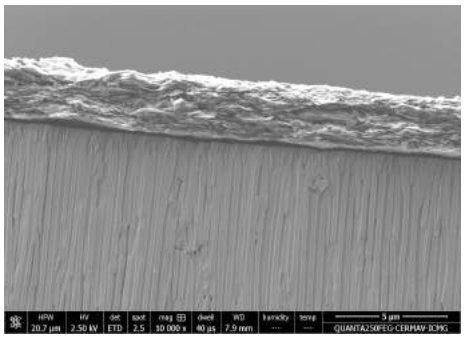

Figure 2: 2.3 µm thick solid film obtained after vacuum filtration of the graphenofluid.