Towards large-scale hexagonal boron nitride 2D layers: a chemical approach

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Interest in h-BN is driven by the combination of several of its characteristics like structural compatibility with graphene, chemical inertness, large band gap of about 6 eV and unique optical properties. These capabilities make it interesting as support for graphene in devices and also as clean, flat insulating environment for 2D materials. However, in order to make h-BN relevant for real world applications, scalable synthesis routes are needed.

As a consequence, we have developed a promising approach to synthesize pure and highly-crystallized h-BN crystals, which can be further exfoliated into high quality, ultra-thin, uniform Boron Nitride NanoSheets (BNNSs) [1]. This new accessible production process represents a relevant alternative source of supply in response to the increasing need of high quality BNNSs. The synthesis strategy is based on a unique combination of Polymer Derived Ceramics (PDCs) route with Spark Plasma Sintering (SPS) process [2]. Through a multi-scale chemical and structural investigation, it is clearly shown that obtained layers are large, defect-free and well-crystallized, which are key-characteristics for a subsequent exfoliation into relevant BNNSs.

References

[1] S. Yuan, B. Toury, C. Journet, A. Brioude, Nanoscale, 6 (2014), pp. 7838-7841

[2] S. Yuan, S. Linas, C. Journet, P. Steyer, V.Garnier, G. Bonnefont, A. Brioude, B. Toury, Scientific Reports, 6 (2016), 20388

Figures

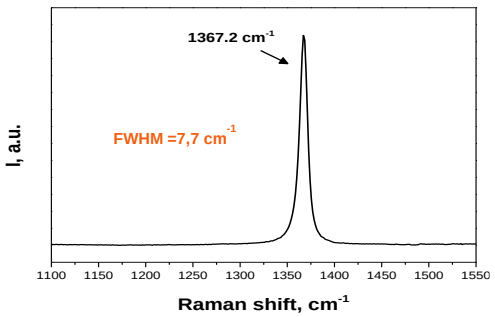

Figure 1: Raman spectrum recorded on the raw sample, showing a FWHM of 7,7 cm^{-1}, characteristic of a sample with very low defect density and very large crystallite size

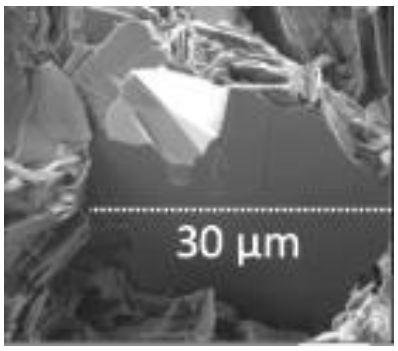

Figure 2: SEM image of the sample, demonstrating fakes size of tens of microns