BN materials for 2D devices: learnings from optical properties

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With the rise of 2D materials, BN layers and crystals have become a strategic material for the fabrication of van der Waals heterostructures. Stacked with any other 2D material either as a substrate or as capping layer or as dielectric layer, it can reveal the best of their physical properties [1, 2]. Up to now, the prototype devices are mostly assembled via mechanical exfoliation and transfer of atomic layers. But active researches are developing worldwide to fabricate the large-surface crystals required for device industrialisation. In this context, optical diagnostics are highly desired to qualify hBN materials for their integration into 2D devices.

In this talk, the recently acquired basic knowledge on the luminescence properties of free excitons in hBN measured by cathodoluminescence [3] and the vibrational properties by Raman spectroscopy [4,5] are exploited for this purpose. The reference data are taken from the high quality crystals grown at high pressure and high temperature (HPHT) mostly used in devices [6]. They are compared with those of hBN materials obtained either using a chemical process followed by high pressure annealing [7] or a direct synthesis at atmospheric pressure (APHT) with boron isotope control. The APHT crystals have been shown recently to be a credible alternative to HPHT ones for high-performance graphene devices [8].

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