Optical characterization of exfoliated monolayer boron nitride by means of hyperspectral microscopy in the deep-UV

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Hexagonal boron nitride (hBN) is an important material in many today technology [1] since the first fabrication of large single crystals by Watanabe et al. [2]. More specifically, hBN is a lamellar material made of sp2 bonded planes stacked through van der Waals interactions, which can be easily separated down to monolayer. This 2D material is a key compound in van der Waals heterostructures used both as a perfect dielectric barrier or as encapsulating layer to improve the properties of surrounding 2D materials [3]. Nonetheless, despite its large range of applications, little is known about the physic inherent to hexagonal boron nitride thin films and the monolayer [4].

By means of hyperspectral photoluminescence spectroscopy in the deep UV, we studied the optical properties of exfoliated hBN thin films down to a monolayer near the band gap energy (6eV) [5]. The hyperspectral images obtained allows us to identify distinct spectral signatures which, by comparing their spatial distribution to AFM data, are unambiguously associated to monolayer, few-layers and stacking faults emissions. We then observe modulations of the hBN photoluminescence spectrum with thickness and a strong bandgap crossover at the monolayer limit with a direct emission around 6.1eV. This work should bring a better understanding of the intrinsic properties of thin films boron nitride down to the monolayer.

References:

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