Towards synthesis and characterization of large scale BN films

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hBN layers has 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]. However, one major obstacle to the realization of hBN-based technology is the difficulty in mastering with scalable techniques synthesis of both thick and thin films and to characterize the quality required for their integration in devices.

In this talk, recent advances made for mastering growth of multilayers continuous films on crystalline substrates with highly ordered epitaxial interfaces will be first reviewed [3, 4]. The second part of the talk will focus on their characterization using Transmission Electron Microscopy (TEM) and Electron Energy Loss (EELS) techniques [5, 6]. We will examine how the structural characteristics (roughness, thickness, size domain, stacking sequence) and the quality (level and nature of the impurities, stacking fault density or crystallinity at the macro and nanoscale) of the BN film can be correlated with the microstructure of the growth substrate. The examination of samples cross-sections prepared by the FIB technique (Figure 1) will be shown to be decisive for the identification of the layers stacking sequence, the fine characterization of the substrate-BN film interface including epitaxial relations ships between the layers and the substrate.

Thanks to this approach we will show the development of CVD heteroepitaxial growth on (111) Ni surfaces of continuous films with the ABC stacking sequence [3] and evidence the growth using a metalorganic vapour phase epitaxy (MOVPE) process of AB stacked layers on epigraphene according to a lateral deposition process [4].

References

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Figures

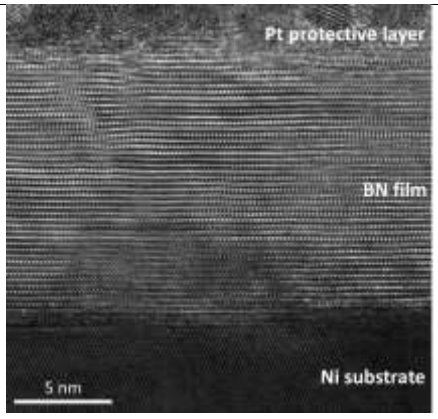

Figure 1: HRTEM image of multilayers BN film grown by CVD on nickel (111) surfaces