Advances on hBN growth on Ni substrate by Plasma Assisted Molecular Beam Epitaxy

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Hexagonal boron nitride (hBN) is an insulator from the 2D materials family receiving an extensive interest in the development of Van der Waals (VdW) heterostructures not only for graphene encapsulation due to its chemical stability but also as tunnel barrier when sandwiched by graphene layers. In this work, we present our recent results on growth of hBN on polycrystalline Ni substrate using a N_2 plasma source and an elemental boron Knudsen cell. We discuss the role of growth parameters into the formation of hBN from one monolayer to few monolayers. We investigated the impact of the B/N flux ratio by varying the boron cell temperature and the plasma parameters on the characteristics of the films (e.g., stoichiometry, shape, size), as shown in fig.1. We also investigated the role of the growth temperature on the thickness of grown hBN and their qualities by raman width analysis. At last, we studied the growth time and we observed a saturation on hBN growth around 5 monolayers with domains lengths up to 20 µm. Although this size limitation needs further studies, our results show a reproducible approach to grow high quality hBN for dedicated applications such as 2D graphene-BN heterostructures.

Figures

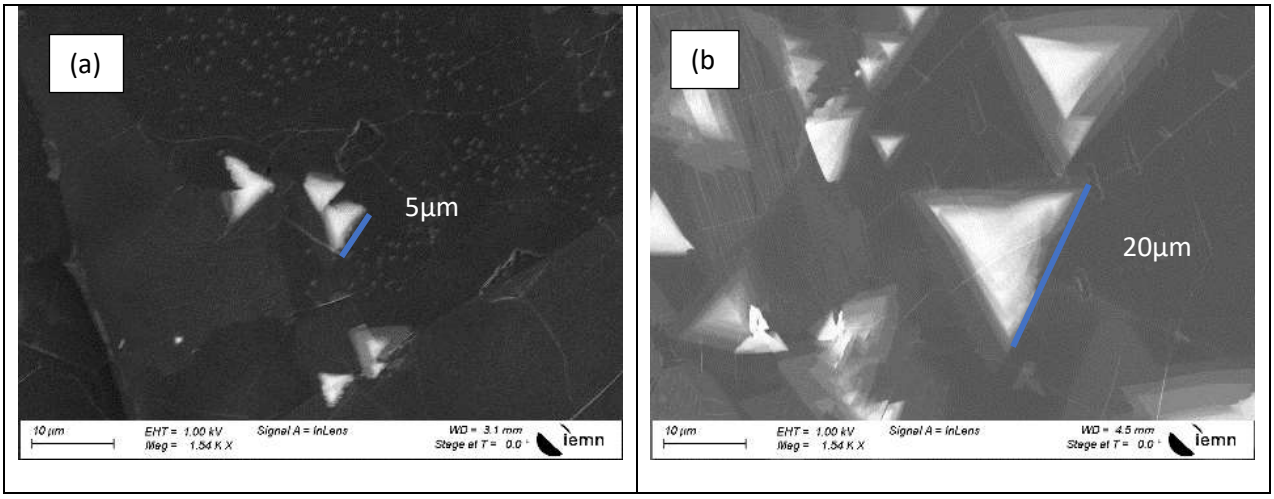

Figure 1: Impact of plasma power and N_2 flow, by optimizing both parameters, increase of hBN islands from 5 µm fig. 1.a (power 540W, N_2 flow 1.5 sccm) to 20 µm fig.1. (580W, N2 flow 5.0 sccm)