*h*BN-Borophene Vertical Heterostructure viaTthermal Decomposition of Borazine on Ir(111)

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Borophene, a new addition to an emerging two-dimensional (2d) material composed of single layer boron atoms with polymorphism features originating from its diverse boron-boron bonding geometries. Here we report synthesizing large single-phase *h*BN-borophene heterostructure utilizing borazine ($B_3H_6N_3$) as the only precursor and of the so-called 'segregation enhanced epitaxy' technique [1]. Using high-resolution electron diffraction, we show both (6x2) reconstruction and moiré pattern, signature for borophene χ6-polymorph [2] and monolayer *h*BN respectively. Additional (4x2) diffraction pattern was also observed from the heterostructure, a superposition between borophene and moiré pattern. Atomic force microscopy (AFM) of the heterostructure shows wrinkle formations an evident of relaxation of *h*BN films on top of the borophene islands while scanning tunneling microscopy (STM) provide high resolution images shows distinction between striped and moiré phased structures. Finally, the growth kinetics of the heterostructure formation was studied by low energy electron microscopy (LEEM) in real-time at different temperatures.

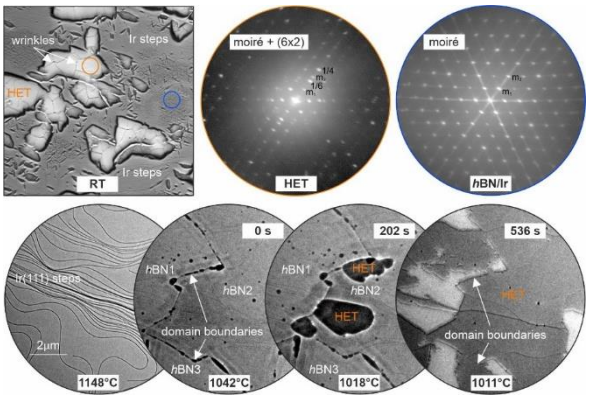

Fig.1 LEEM bright field images at room temperature (RT). Micro-LEED of *h*BN-borophene heterostructure and *h*BN on Ir (111). Series of LEEM images for the two-step growth method at different temperatures.

References

[1] K. Omambac et. al. ACS Nano **15**, 7421-7429 (2021).
[2] N. A. Vinogradov et. al. ACS Nano **13**, 14511-14518 (2019).

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