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Investigation of 2D boron systems on well-defined metallic substrates

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Abstract

The isolation of graphene in 2004 by Geim and Novoselov *et al* [1] has inaugurated a novel discipline in physics: the physics of two-dimensional materials (2DMs). Shortly afterwards, basic and applied research in both the physics and chemistry of 2D materials has extensively expanded beyond the scope of graphene to other 2DMs. Among them are hexagonal boron nitride (hBN), transition metal dichalcogenides and elemental 2DMs such as silicene, germanene, phosphorene and borophene (Bo) [2]. Bo is a polymorphic B-based sheet which does not occur in layered bulk form in nature as many other 2DMs. To date, monolayer borophene sheets and nanoribbons with different phases have been experimentally synthesized and characterized on diverse metallic substrates such as Ag(111), Au(111), Cu(111), Ir(111) and Al(111) [3]. However, besides the demand for high-quality and large-area synthesis, borophene manipulation for device fabrication and its transfer to arbitrary substrates remain challenging [4]. In this seminar, we intend to present an overview of worldwide Bo research and to highlight our potential contribution. We consider synthesizing large-area Bo sheets on different metallic substrates such as Ir(111), Ni(111) and Cu(111) via vacuum-based growth methods, and conducting photoemission, crystallographic and morphological studies of these systems in pristine and modified (e.g., via adsorption and/or intercalation) forms.

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[2] N. R. Glavin *et al.*, “Emerging Applications of Elemental 2D Materials,” *Advanced Materials*, vol. 32, no. 7, pp. 1–22, 2020, doi: 10.1002/adma.201904302.
[3] M. Ou *et al.*, “The Emergence and Evolution of Borophene,” *Advanced Science*, vol. 8, no. 12. John Wiley and Sons Inc, Jun. 01, 2021. doi: 10.1002/advs.202001801.
[4] Z. Zhang, E. S. Penev, and B. I. Yakobson, “Two-dimensional boron: Structures, properties and applications,” *Chem Soc Rev*, vol. 46, no. 22, pp. 6746–6763, 2017, doi: 10.1039/c7cs00261k.