Borophene: Synthesis, Characterization and Electronic Structure of 2D Boron

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ABSTRACT

Limits on the scalability and tunability of graphene have compelled researchers to seek other 2D materials for the sake of both basic and applied research. This seminar aims at providing an overview of 2D boron, a planar boron allotrope known as borophene, with focus on its synthesis, characterization and electronic structure. Since the realisation of epitaxial borophene on Ag(111), reported independently by two groups in 2015 [1] and 2016 [2], there has been a growing interest in revealing the morphology and properties of borophene on various metallic substrates [3]. Polymorphism of borophene, arising from its electron deficiency (Z = 5), allows for the atomic-scale design of both structure and properties. The structure of borophene is often characterised by hollow hexagons in an otherwise triangular lattice whose concentration η is a crucial parameter for its stability. Furthermore, the metallic character of borophene and the occurrence of Dirac cones in some of its phases render it a potential complement to graphene, hexagonal boron nitride, and metal dichalcogenides that may be ultimate building components in novel optoelectronic devices. Quantifying the formation parameters of borophene sheets grown epitaxially on metal substrates other than Ag(111) and experimental mapping of corresponding band structures employing ARPES remain a challenge to date.

Keywords: borophene, polymorphism, electron deficiency, hollow hexagons concentration, Dirac cones, band structure

References:

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