



量子物理学・ナノサイエンス第 289 回セミナー

Transferred large scale single layers of hexagonal boron nitride

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概要

Two dimensional van der Waals materials may be stacked layer by layer and allow for the realisation of otherwise impossible properties of condensed matter systems. This perspective relies on the availability of inert 2D materials, where based on its properties boron nitride is expected to be a key player.

I will report on the isolation of centimeter sized single orientation, single layer boron nitride from its metal growth substrate and its atomic level characterization [1]. To demonstrate the quality of the material on a large scale it was employed as a packing layer to protect germanium from oxidation in air and at high temperature. A second set of experiments involved the nanoscale engineering of the h-BN layer with the “can opener effect” [2] prior to the transfer. This allowed the realization of boron nitride membranes with 2 nm voids, across which we measured ion transport in aqueous solutions. The new BN exfoliation process involves in a first step the application of tetraoctylammonium (TOA) from a water free electrochemical reaction with the h-BN/Rh(111) substrate before the standard hydrogen bubbling. With high-resolution x-ray photoelectron spectroscopy, atomic force microscopy and density functional theory we identify the proximity of the metal substrate to enable covalent functionalization of h-BN with TOA constituents [3].

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- [1] Centimeter-Sized Single-Orientation Monolayer Hexagonal Boron Nitride With or Without Nanovoids, H. Cun et al. Nano Lett. 2018, **18**, 1205.
- [2] Two-Nanometer Voids in Single-Layer Hexagonal Boron Nitride: Formation via the “Can-Opener” Effect and Annihilation by Self-Healing, H. Cun et al. ACS Nano 2014, **8** 7423.
- [3] Catalyst proximity induced functionalization of h-BN with quat-derivatives, A. Hemmi et al. Nano Lett. 2019, **19**, 5998.

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