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S E M I N A R
on
Semiconductor Physics and Nanotechnology

Mo, 05.12.2022, 11:15 Uhr,

Seminar in person in the Physics lecture hall *or* via Zoom

"Using Ir(111) for novel 2D materials beyond epitaxial graphene: tunable heterostructures and borophene"

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Epitaxial graphene (Gr) is a source for large-scale applications development but also a building block for the investigation of novel functionality of more complex systems based on it, e.g. vdW heterostructures. Among epitaxial graphene systems, Ir(111) as a substrate is heavily investigated due to the high uniformity of grown graphene. In addition, Gr/Ir(111) can be easily engineered by the adsorption and intercalation of atomic species and different layers.

With the growing interest in various transition metal dichalcogenides (TMDs), Gr/Ir(111) became an appealing substrate for the molecular beam epitaxy (MBE) growth of various TMDs. With that respect, our research interest evolved in three directions which will be presented. First, the possibility to prepare high-quality MoS_2 nanoislands on a uniform graphene layer and to exfoliate that system from Ir(111) outside UHV, and investigate its optoelectronic properties, in particular by Raman and photoluminescence (PL) spectroscopy [1]. Secondly, we formed MoS_2 and WS_2 lateral and vertical heterostructures and investigated their properties by means of scanning tunneling spectroscopy (STS). Thanks to relatively weak interaction with the substrate, heterostructures revealed their free-standing character and sharp heterojunctions [2]. Thirdly, the particular aspect of substrate interaction was studied further, where we established the possibility to fine-tune TMD-substrate interaction by means of so-called self-intercalation, using chalcogen or metal atom intercalation below graphene, which induced non-rigid band shifts and strain modification within the TMD layer [3].

Finally, in the last part, we exploit Ir(111) surface for the large-scale growth of borophene by executing segregation-assisted epitaxy based on chemical vapor deposition (CVD), in which Ir substrate is exposed to borazine vapors in a vacuum at high temperatures. Borophene is an atomically thin sheet of boron atoms and it gains lot of attention due to its exceptional physical and chemical properties. High-quality samples were characterized by X-ray photoelectron spectroscopy (XPS) and angle-resolved photoelectron spectroscopy (ARPES), where information on binding and

electronic structure is obtained. Further, it is demonstrated how to successfully transfer single-phase monolayer borophene to arbitrary substrates providing a possibility for e.g. Raman spectroscopy characterization [4] which still needs to be firmly established as a standard Borophene characterization tool, as in the case of other 2D materials, e.g. graphene.

[1] V. Jadriško et al., FlatChem 34 (2022) 100397.
[2] B. Pielić et al., ACS Applied Materials & Interfaces 13 (2021) 50552–50563.
[3] B. Pielić et al., in preparation (2022).
[4] B. Radatović et al., ACS Applied Materials & Interfaces 14 (2022) 21727–21737.

Zoom – Link:

https://zoom.us/j/96375934537?pwd=RTlKTWhSdzRHU211YTY1bGFxTUtpZz09

Meeting-ID: 963 7593 4537

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