O 63: 2D Materials beyond Graphene

Time: Wednesday 18:15–21:00 Location: Poster A

O 63.1 Wed 18:15 Poster A

XPS study of mecanical exfoliated molybdenum disulphide — •Philipp Espeter, Dominique Handschak, Christoph Keutner, Peter Roese, Ulf Berges, and Carsten Westphal — Experimentelle Physik I/DELTA, TU Dortmund, Otto-Hahn-Straße 4, 44221 Dortmund, Germany

The transition metal dichalcogenide molybdenum disulphide (MoS_2) belongs to the layered materials with a strong in-plane and weak out-of-plane bonding. Thinning bulk MoS_2 down to monolayer thickness influences its electronic proporties. MoS_2 monolayer with direct bandgap of about $1,9$ eV is a promising candidate for applications in electronic and opto-electronic devices. We report on the results of XPS investigations of mechanical exfoliated molybdenum disulphide conducted at the PGM undulator beamline 11 of Dortmund's synchrotron source DELTA. Vacancy formation due to the exfoliation process is monitored as well as the occupation of sulfur lattice sites and vacancies by oxygen.

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Unoccupied electronic states in silicene nanoribbons on Ag(110) — •Luca Bignardi[1], Fabian Kleimeier[1], Mohammed Rachid Tchalala[2], Hamid Oughaddou[2,3], and Helmut Zacharias[1] — [1]Physikalisches Institut, Westfälische Wilhems-Universität, Wilhlem-Klemm-Str. 10, 48149 Münster, Germany — [2]Institut des Sciences Moléculaires d'Orsay, ISMO-CNRS, Bâtiment 210, Université Paris-Sud, 91405 Orsay, France. — [3]Département de Physique, Université de Cergy-Pontoise, 95000 Cergy-Pontoise, France

In the last few years, silicene, a honeycomb 2D lattice of Si atoms, has emerged as a potential candidate for new-generation electronic devices, with the advantage of being compatible with existing semiconductor technologies. A full technological exploitation of this material requires a comprehensive characterisation of its occupied and unoccupied electronic structure.

Deposition of silicon on Ag(110) single-crystals is known to result in the formation of self-assembled silicene nanoribbons, showing a (2x5) overlayer. In this contribution, we present an investigation of the unoccupied electronic states of this interface. By means of inverse photoemission spectroscopy (IPE), we identify the electronic empty states due to the silicene nanoribbons. Moreover, we provide a description of the modifications induced by the Si overlayer on the unoccupied states of the metallic substrate.

O 63.3 Wed 18:15 Poster A

Structural Analysis of MoS_2 on Au(111) by X-ray Standing Waves — •caio silva[1], ferdinand farwick zum hagen[1], wouter jolie[1], christoph schlueter[2], tien-lin lee[2], and carsten busse[1] — [1]II. Physikalisches Institut, Universität zu Köln, Germany — [2]Diamond Light Source, United Kingdom

The present work clarifies important aspects of the structure of MoS_2 epitaxially grown on Au(111) by physical vapor deposition. The results are very significant to understand the interaction between transition-metal dichalcogenides (TMDCs) and metallic substrates. TMDCs present fascinating electronic, optical and catalytic properties. Remarkable differences are found in the single-layered TMDCs in contrast to the bulk material, e. g. transition from indirect to direct band gap and spin-orbit-induced spin splitting due to the symmetry loss. Determination of the structure down to the atomic level is crucial in understanding the correlation between these properties and the morphology.

X-ray standing waves (XSW) has been used to study the average distances between the single-layer S-Mo-S to substrate surface. Chemical analysis was performed by means of high-resolution x-ray photoelectron spectroscopy (XPS) and low-energy electron diffraction (LEED) was used to elucidate the sample quality and the in-plain structure of MoS_2/Au(111).

O 63.4 Wed 18:15 Poster A

Epitaxial growth of MoS_2 monolayers on graphene/SiC — •Maciej Dendzik[1,2], Jill Miwa[1,2], Soren Ulstrup[1,2], Signe Gronborg Sorensen[2], Antonija Grubisic Cabo[1,2], Marco Bianchi[1,2], Matteo Michiardi[1,2], Jeppe Vang Lauritsen[2], and Philip Hofmann[1,2] — [1]Aarhus University, Department of Physics and Astronomy, Aarhus, Denmark — [2]Aarhus University, Interdisciplinary Nanoscience Center, Aarhus, Denmark

Monolayers of transition metal dichalcogenides (TMDCs) are a novel class of materials which recently attracted considerable attention due to their interesting physical properties and possible applications in fields of electronics and spintronics. Nevertheless, the growth of high quality single-layered films of TMDCs still remains a challenge. Here we present an in situ physical vapour deposition approach of growing MoS_2 monolayers. Intermediate stages of the process are characterised by means of scanning tunneling microscopy, providing an insight into the growth mechanism. Grown samples are further investigated by angle resolved photoemission and compared with MoS_2 monolayers grown on Au(111). The results indicate high quality and large coverage of the monolayer.

O 63.5 Wed 18:15 Poster A

Growth and characterization of thin MoS2 layers by CVD — •Gregor Nordheim, Martina Wanke, Adrian Schütze, Florian Speck, and Thomas Seyller — Institut für Physik, TU Chemnitz, Reichenhainer Str. 70, D-09126 Chemnitz, Germany

MoS2 is a two-dimensional layered material like graphene, with a hexagonal structure and weak van der Waals forces between the layers. In contrast to graphene, MoS2 has a band gap which makes it an interesting material for electronic and optoelectronic applications. Chemical vapor deposition (CVD) is a promising approach to synthesize uniform, high quality monolayer and few layer MoS2 films on various substrates such as silicon oxide, sapphire [1-3].

We report on the growth and characterization of MoS2 using a custom build CVD setup. Epitaxial monolayer graphene and the buffer layer on SiC(0001) synthesized by sublimation growth in Ar [4] were used as substrates. The samples were analyzed by X-ray photoelectron spectroscopy (XPS) in order to obtain information about their chemical composition and the thickness of the layers. In addition, the MoS2 layers were studied by atomic force microscopy (AFM).

[1] Y. Yu et al., Scientific Rep. 3 (2013) 1866. [2] M.R. Laskar et al., Nat. Mater. 102 (2013) 252108. [3] Y.-H. Lee et al., Nano Lett. 13 (2013) 1852. [4] K.V. Emtsev et al., Nat. Mater. 8 (2009) 203.