O 76: Poster Focus Session Atomic Scale Investigation of Magnetic 2D Materials

Time: Wednesday 18:00–20:00 Location: P2

O 76.1 Wed 18:00 P2

Unconventional magnetic response in epitaxial-grown single-layer Cr_2S_3-2D — •Affan Safeer[1], Calisa Carolina Oliveira[2], Mahdi Ghorbani-Asl[3], Jörg Schöpf[1], Wouter Jolie[1], Amilcar Bedoya-Pinto[2], Arkady V. Krasheninnikov[3], Thomas Michely[1], and Jeison Fischer[1] — [1]Universität zu Köln, Köln, Germany — [2]University of Valencia, Paterna, Spain — [3]Institute of Ion Beam Physics and Materials Research, Dresden, Germany

We studied the magnetic ordering in epitaxially-grown single-layer Cr_2S_3-2D on Gr/Ir(110) using X-ray magnetic circular dichroism (XMCD), scanning tunneling microscopy (STM) and spectroscopy (STS). Prior characterization of the 2D material structure via low-energy electron diffraction (LEED), STM, and density functional theory (DFT) calculations confirmed that single-layer Cr_2S_3-2D has a NiAs-type structure. DFT calculations further predicted that the ground state could be either A-type antiferromagnetic or ferromagnetic, depending on the Hubbard parameter. Differential conductance STS measurements as a function of the out-of-plane magnetic field at 1.7 K show a hysteresis behavior with a switching field of about 4T, indicating a ferromagnetic ordering. In contrast, XMCD measurements on the same sample revealed no signal, indicating zero net magnetic moment, suggesting antiferromagnetic behavior.

O 76.2 Wed 18:00 P2

Atomically thin $MnBr_2$ grown by molecular-beam epitaxy on graphene/Ir — Oktay Güleryüz, Affan Safeer, Nicolas Georgopoulos, Thomas Michely, and •Jeison Fischer — II. Physikalisches Institut, Universität zu Köln, Zülpicher Straße 77, 50937 Köln, Germany

We report on the growth of potentially magnetic manganese dibromide ($MnBr_2$) films on graphene/Ir substrates using molecular-beam epitaxy. $MnBr_2$ is evaporated as a single compound from an effusion cell onto the graphene/Ir. Low-electron energy diffraction analysis reveals that the hexagonal lattice constant of $MnBr_2$ amounts to 0.390 ± 0.005 nm, consistent with calculated 0.3885 nm and bulk 0.3873 nm values.
Our scanning tunneling microscopy study reveals that the best growth conditions to form large, compact monolayers involve deposition at elevated temperatures (400 K). Growth at low temperature on graphene/Ir(110) leads to the formation of small islands with a distribution of orientations. A new moiré superstructure is formed, which reflects the interaction of the $MnBr_2$ lattice with the corrugated graphene/Ir(110) moiré.
Low-temperature scanning tunneling spectroscopy at 1.7 K of monolayer $MnBr_2$ further reveals a significant band gap of approximately 5 eV. Additionally, isolated polarons are observed, which can be manipulated, created, and destroyed by the STM tip.

O 76.3 Wed 18:00 P2

The Nickelocene as an STM Atomic-Spin Sensor via cotunnelling theory — •Andres Pinar Sole[1,2], Manish Kumar[1], Diego Soler-Polo[1], Oleksandr Stetsovych[1], and Pavel Jelinek[1] — [1]Czech Institute of Physics, Cukrovarnicka 10, Prague 6, 16200 (Czech Republic) — [2]Center for Quantum Nanoscience (QNS) Research Cooperation Building Ewha Womans University, 03760 Seoul, (Republic of Korea)

Functionalization of a scanning microscopy probe with a single nickelocene attached to the tip allows reproducible spin-sensitive measurements of magnetic systems on surfaces. As a S=1 molecule, the triplet ground state of the nickelocene tip gives rise to a inelastic electron spin-flip excitation which changes upon interactions with spin systems on the surface. Some advantages of nickelocene functionalization compared to spin-polarized tips include tip passivation, enabling data acquisition at close tip-sample distances and well defined spin and tip apex. These features enable us to determine the local spin moment on the surface with atomic-scale precision.

While the interactions between the nickelocene spin and the magnetic centers has been modelled using a two-site Heisenberg Hamiltonian, we complement it to include the tunnelling current as an electronic transport phenomenon via cotunneling theory. It allows understanding the absence of transitions that are not allowed according to the selection rules or have relatively weaker intensity. We cover $S = 1/2$, 1, and $3/2$ systems, as well as 2D magnetic materials and compare the simulations with experimental results.