Contribution submission to the conference Regensburg 2022

On the transition from MoS_2 single-layer to bilayer growth on the Au(111) surface — •Moritz Ewert[1], Lars Buss[1], Francesca Genuzio[3], Tevfik Onur Menteş[3], Andrea Locatelli[3], Jens Falta[2], and Jan Ingo Flege[1] — [1]Applied Physics and Semiconductor Spectroscopy, Brandenburg University of Technology Cottbus-Senftenberg, Germany — [2]Institute of Solid State Physics, University of Bremen, Germany — [3]Elettra-Sincrotrone Trieste S.C.p.A., Basovizza, Trieste, Italy

MoS_2 is well known for changing from an indirect to a direct band-gap semiconductor as a single layer. Here, for the model system MoS_2/Au(111), we present in-situ studies of the continued growth of micron-size single-layer MoS_2 islands including the first formation of bilayer patches.

We have used angle-resolved photoemission spectroscopy from micrometer sized regions to investigate the local band structure of the islands' rims and centers, showing a prevalence for bilayer and single-layer formation at the rims and centers, respectively. The bilayer patches can clearly be identified locally on the few nanometer scale employing intensity-voltage low-energy electron microscopy as a fingerprinting method. Astonishingly, micro-spot low-energy electron diffraction hints toward the nucleation of the second layer of the MoS_2 between the single layer MoS_2 and the Au(111) substrate when the step bunches formed by the single-terrace growth mechanism become sufficiently high.

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