UNIVERSITÄT LEIPZIG

Fakultät für Chemie und Mineralogie
Wilhelm-Ostwald-Institut für
Physikalische und Theoretische Chemie

Kolloquium des Wilhelm-Ostwald-Instituts

Prof. Dr. Alf Mews
Universität Hamburg

Montag, 16. Mai 2022, 17:15 Uhr

Wislicenus-Hörsaal, Johannisallee 29, 04103 Leipzig

Heterostructures in two-dimensional colloidal metal chalcogenides: Preparation and electronic properties

Abstract
Two-dimensional nanosheets have become increasingly important in recent years because they combine material properties that arise from their nanoscopic thickness with extended lateral dimension. Here we show that complicated heterostructures consisting of different materials can be prepared by selective surface chemistry and how this leads to distinct electronic properties.In the first part of the talk we will focus on chemical synthesis techniques to prepare different metal chalcogenide nanoplatelets of SnSe, SnS and CuS. Here we use the so called hot-injection technique where anionic precursors are injected into a hot solution of oleylamine in the presence, e.g. Cu-halides. We show how the initial nucleation of such platelets takes place and how different ligands can be used to adjust the surface energy of different facets to precisely control the morphology of the small nanoplatelets and larger nanosheets. In the next part we focus on the formation of hetero-structures by post synthesis modification. Firstly, we show how the successive addition of sulfur- and selenium precursors leads to the growth of radial core-crown heterostructures from SnSe and SnS. Then we demonstrate how heterostructures from CuS and CdS can be prepared by partial cation exchange of Cu vs. Cd. Finally, we show examples of heterostructures from nanoplatelets and metal nanocrystals. Here we adjusted the reaction conditions in a way that the metal particles grow exclusively on the edges of the nanoplatelets. Besides the formation of such complex nanostructures, we are highly interested in their specific optoelectronic properties. In particular we focus on the charge distribution within the nanoplatelets upon local illumination. Firstly, we show examples where individual nanosheets are locally illuminated with a confocal microscope and simultaneously studied by Kelvin-Probe Force Microscopy (KPFM) to investigate how the photo generated charges are spreading over the platelet. Then we present photocurrent measurements on individual nanosheets which are contacted with lithographically defined contacts. Here the local illumination was achieved either by optical or by synchrotron radiation. In essence we show how a combination of chemical synthesis and modification with microscopic investigation of individual nanostructures can pave the road toward new promising materials for several application in the field of e.g. photocatalysts or solar cells.

Ab 16:30 Uhr findet ein gemeinsames Kaffeetrinken in Raum 410 (TA) statt.