Institute of Physical Chemistry (IPC)

Master Thesis

"Growth of atomically thin transition metal dichalcogenides sheets for functional applications in electronic and optoelectronic devices"

Recently a novel class of atomically thin two-dimensional (2D) materials like graphene (Nobel Prize 2010), transition metal dichalcogenides (TMD) or carbon nanomembranes (CNMs) has attracted a huge research interest due to their superior electronic and optical properties with many promises for novel functional applications in nanotechnology. For instance, these materials are promising candidates for high performance flexible electronics, nanobiosensors or energy storage devices. Some of the most important activities in this field are the growth of these materials with desired properties, microfabrication and integration into devices.

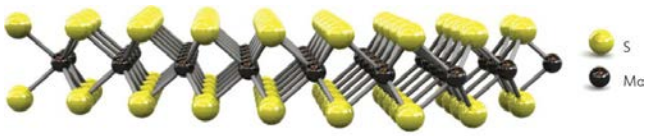

Fig. 1: A single layer of TMD is a few angstroms thick and consists of transition metal atoms (black) sandwiched between two layers of chalcogen atoms (yellow).

The objective of this Master project is to develop strategies for the synthesis of large area TMD monolayers (e.g., MoS_2, WS_2 or $MoSe_2$, see Fig. 1) using chemical vapor deposition (CVD) techniques. The grown sheets will be characterized by complementary spectroscopy and microscopy techniques (Raman spectroscopy and X-ray photoelectron spectroscopy as well as atomic force, electron and optical microscopy). The thesis will be conducted as a part of a collaborative research within a highly motivated team of material scientists, chemists and physicists. The grown TMD sheets will be employed for testing of novel electronic and optoelectronic device concepts in our group and of novel photonic structures in collaboration with the Institute of Applied Physics.

Techniques and methods that will be employed in this project and your benefits:

- CVD growth of TMD sheets, their transfer onto new substrates, assembly of novel layered structures
- Raman and X-ray photoelectron spectroscopy; atomic force, electron and optical microscopy
- Microfabrication on atomically thin sheets
- Team work with national and international scientists
- At the end of the MSc-project an opportunity for a PhD-project within the running EU Horizon 2020 projects ("Graphene-based disruptive technologies", "Platform for ultra-sensitive Point-of-Care diagnostics for Infectious Diseases", etc.)

Your qualification

- Bachelor in Chemistry, Physics or Materials Science
- High motivation

Contact: Prof. Dr. Andrey Turchanin

Group of Applied Physical Chemistry & Molecular Nanotechnology
Lessingstr. 10, R136
Tel.: (03641) 948370
E-mail: **andrey.turchanin@uni-jena.de**
Web: **http://www.apc.uni-jena.de/**