

Monolayer-WSe₂ based heterostructures for light emitting diodes

Advertising institute: PGI-9 Semiconductor Nanoelectronics

Reference number: Physics, Electronics

Job description:

Monolayers of transition metal dichalcogenides (TMDs) such as (Mo,W)(S,Se)₂ have been shown to possess some unique properties making them ideal for novel optoelectronic devices. Those include a direct bandgap in the visible light spectral range which can be tuned with the material composition and a very large exciton binding energy. In addition, very strong spin-orbit interactions, spin - valley - photon polarization coupling and strong many-body interactions offer new functionalities not available with standard inorganic semiconductors. In order to make use of these possibilities, devices based on heterostructures are particularly attractive as doping of TMDs is still not well established.

In this project you would develop a heterostructure for tunnelling light emitting diode with a monolayer (W, Mo)Se₂ as an active area. The project will require fabrication and measurements of the devices with an emphasis on optimisation of tunnelling barriers for both hole and electron injecting layers and potentially optimization of the interactions with the substrate. The latter may be used for applying magnetic field or to structure optical density of states.

You will acquire practical knowledge of nanofabrication techniques and associated characterization methods while fabricating the devices in the clean room. You will perform electrical characterisation of the devices, analyse the resulting electroluminescence, compare with the photoluminescence and quantify quantum efficiency between room and liquid helium temperatures. Finally you will analyse the possibility of using the interactions with the substrate to manipulate the polarization of the electroluminescence.

Your profile:

The successful candidate should

- Have a Bachelor degree in Physics or Electrical Engineering
- Be able to work independently and in a small team
- Enjoy working in a laboratory
- Have good communication and documentation skills
- Be able to get to the heart of a problem and to solve it quickly and efficiently

Please send your application (including CV, Bachelor thesis and exam results) by email to Prof. Beata Kardynal (b.kardynal@fz-juelich.de)