ETH zürich

Semester Project

Ab-initio Investigation of Leakage Current in Metal/Oxide/2D-Semiconductor Devices

The big picture

2D material-based transistors, leveraging materials like graphene and TMDs, are at the forefront of nanoelectronics. These ultra-thin materials offer unique electronic properties, with the dielectric layer playing a crucial role. Positioned between the gate electrode and the 2D material channel, the quality of the dielectric layer significantly influences the device performances. One major challenge in 2D material-based FETs is the issue of gate leakage. Gate leakage refers to the unwanted tunneling of electrons through the gate dielectric, which degrades device performance, increases power consumption, and limits the scaling potential of these transistors.

Description

This semester project focuses on the computational exploration of gate leakage in Metal/Oxide/2D-Semiconductor devices using a combination of density functional theory (DFT) and non-equilibrium Green's function (NEGF) formalism. DFT-NEGF provides a powerful framework to model quantum transport in nanoscale devices, enabling an accurate description of electron behavior in the presence of quantum tunneling and other leakage mechanisms.

Type of work

Theory (25%) – model development (15%) – Simulation and analysis (60%)

Prerequisite

Interest in device-physics

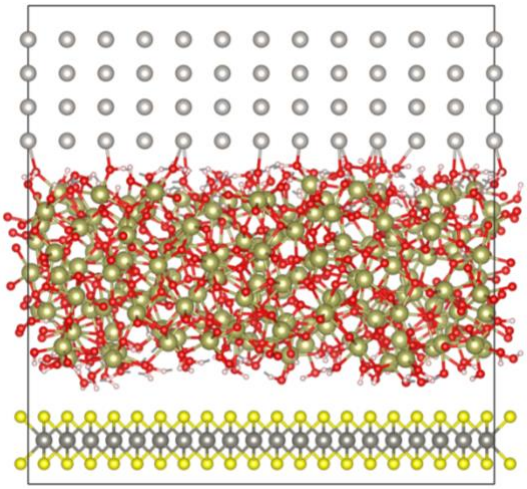

Illustration of a Pt-HfO_2-WS_2 stack

Status: Available

Looking for 1 Semester student

Interested candidates please contact: Mauro Dossena mdossena@iis.ee.ethz.ch

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