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S E M I N A R
on
Semiconductor Physics and Nanotechnology

Mo, 06.03.2023, 11:15 Uhr,

Seminar in person in the Physics lecture hall *or* via Zoom

"Silicon and Germanium nanostructures for electrical, optical and plasmonic applications"

Prof. Dr. Alois Lugstein

Institute for Solid State Electronics, Vienna University of Technology, Austria

Due to physical limits and short channel effects a shift towards the adoption of new materials and novel design architectures is predicted to insure further improvement of modern ICs technology with respect to integration densities, power dissipation and performance. Nanowires and sheets are predicted to be one of the most promising building blocks for future ultra-scaled high-speed nano- and opto-electronics.

I will address the controlled formation of monolithic metal (Al) – semiconductor (Si/Ge) nanowire and nanosheet heterostructures. The main obstacles facing towards reliable synthesis of such hybrid systems are related to lateral strain relaxation, mitigating the limitations of material lattice compatibility and allow arbitrarily combined dissimilar materials unattainable in layered structures. Out of the wide range of nanowires, Ge combines a high carrier mobility, with a more than five times larger exciton Bohr radius compared to Si. Hence, Ge is of particular interest especially for the development of high speed and novel quantum devices.

The formation of axial Al-Ge-Al nanowire heterostructures with atomically sharp interfaces and monocrystalline aluminum leads by using a thermally initiated exchange reaction will be presented. This enables the fabrication of an in line contacted quantum dot without requiring precise lithographic alignment of the contacts, which is one of the most challenging issues of fabricating quantum dot based devices. Unambiguous signatures of quantum ballistic transport and electrostatically tunable negative differential resistance even at room temperature will be demonstrated and attributed to intervalley electron transfer.

Together with the wafer-scale accessibility, the proposed fabrication scheme may give rise to the development of key components for a broad spectrum of emerging Si and Ge-based devices requiring monolithic metal-semiconductor−metal heterostructures with high-quality interfaces for electrical, optical and plasmonic applications.

Zoom – Link:

https://zoom.us/j/96375934537?pwd=RTlKTWhSdzRHU211YTY1bGFxTUtpZz09

Meeting-ID: 963 7593 4537

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