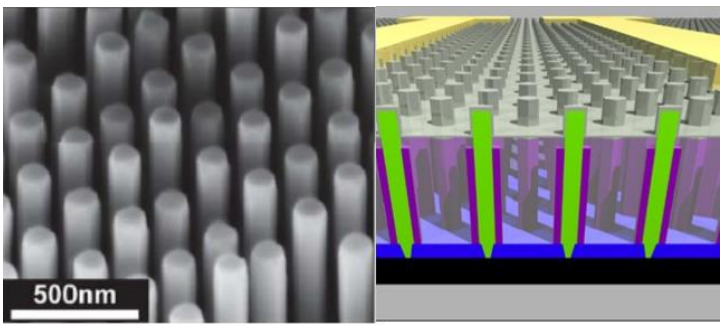
Master Thesis

3D-Structured III-V Nanowires for Ultrahigh-Efficiency Solar Cells

At the Walter Schottky Institute (WSI-TUM) we recently launched a research project directed to the exploration of new types of high-efficiency solar cell systems based on 3D-structured III-V semiconductor nanowires.

Conventional single-cell photovoltaic devices are known to have performance limits due to large thermal and spectral losses, light trapping issues and charge carrier losses. To overcome these problems 3D-structured nanowire (NW) solar cells have emerged as promising systems with improved light trapping and absorption properties beyond the ray-optic limit, as well as better carrier collection efficiencies.

The goal of this M.Sc. project is to exploit the advantages of 3D-structured III-V semiconductor NWs and work towards a novel hot carrier solar cell (HCSC), which allows to selectively cool charge carriers and reduce thermal losses. Hereby, you will be closely working together with two PhD students to first design proper bottom-up III-V NW heterostructures from the group-III-V family of semiconductors. Exploiting the full geometrical and energy-selective parameter space, the design will be directly guided by in-depth simulations for enhanced photoabsorption and effective carrier thermalization properties. NW heterostructures on lithographically patterned substrates should then be realized by top-down/bottom-up nanofabrication processes and further characterized by various optical spectroscopy methods (photoluminescence, FTIR, and UV-Vis-NIR absorption spectroscopy. Finally, the goal is to identify correlations between array-geometry, NW dimensions, and electronic properties of the selected heterostructure material (band gap and strain) and the corresponding optical and charge carrier responses.



You will gain & learn:

- Knowledge in electromagnetic (FDTD) and electronic band structure simulations
- Advanced lithography / clean-room processes for state-of-the art 3D structured NWs
- Diverse optical spectroscopy (micro-Photoluminescence, FTIR, UV-Vis-NIR absorption)
- Correlated microscopy methods (SEM, He-Ion Microscopy)

Experience in the area of clean room fabrication, optical spectroscopy or nanoanalytics, as well as experience in simulations is a benefit, but secondary to motivation and commitment. Applications should be sent to Gregor.Koblmueller@wsi.tum.de. Please include your CV, and a transcript of records (Bachelor & Master).

Date: May 2019