

PhD Student in Hexagonal SiGe Integrated Optoelectronics

fixed-term (3+ years) starting 2022

The **Semiconductor Quantum Nanomaterials Group** at the Walter Schottky Institute (WSI), Technical University of Munich (TUM) is looking for a doctoral student (m/f/d) in the field of integrated optoelectronics / photonics of emerging group-IV semiconductors. The position is for a limited period of 3 years with possible extensions, and the candidate is expected to develop on-chip integrated light emitters using new direct-gap hexagonal SiGe alloys.

Project background

Silicon and its alloys have dominated the electronics industry for more than half a century. Together with other group-IV semiconductors, Si crystallizes in a cubic crystal structure leading to an indirect band-gap and very poor light emission. Recent breakthroughs in materials synthesis offer now possibilities for other crystal structures, such as hexagonal phase (hex-SiGe), which enables a new class of direct band gap semiconductor with very efficient light emission. With emission in the technological 1.55-4.0 μm wavelength range, spanning both the low-loss region for optical fibres and molecular fingerprint regions, hex-SiGe opens large scope for CMOS optoelectronic integration as well as novel applications for integrated nanoscale sensors.

Job description

The aim of this PhD project is to explore integration of hex-SiGe nanostructures onto silicon-on-insulator (SOI) photonic platform for integrated optoelectronics applications. Emphasis will lie in the development of coherent light emitters, including lasers, either as intrinsic or via extrinsic resonator cavities with emission tailored in the mid-IR range of $\sim 3\text{-}4\ \mu\text{m}$. Central tasks involve the design, simulation, and fabrication of suitable gain media and resonator cavities using numerical simulation and cleanroom fabrication methods. Steady-state and time-resolved optical spectroscopy of photonic and optoelectronic properties will be performed on custom-built setups to investigate gain and carrier dynamics of functional hex-SiGe integrated systems. The project will benefit from close collaboration with groups active in synthesis and theory, supported by the International Graduate School of Science and Engineering (IGSSE) at TUM.

Candidate profile:

Candidates are expected to hold a M.Sc. degree in physics, electrical engineering, materials science or similar with outstanding academic record and should possess exceptional motivation and creativity combined with very good communications skills and proficiency in English (oral and written). A strong background in optoelectronics and photonics of semiconductor-based nanostructures both experimentally and theoretically is an advantage. Knowledge of state-of-the-art nanofabrication, advanced optical spectroscopy, and electro-optical simulation is considered an asset. Hiring will start immediately (01/2022).

Interested applicants should submit their application including cover letter (motivation), CV, list of 3 references and relevant documentation (transcripts, certificates) to the PIs of the project by **Email: Gregor.Koblmueeller@wsi.tum.de or Jonathan.Finley@wsi.tum.de**
PD Dr. G. Koblmüller / Prof. Dr. J. Finley, Walter Schottky Institut, TUM, www.wsi.tum.de

