

SiCqurTech: Silicon Carbide Qubits towards a Fab-Ready Technology

SiCqurTech focuses on vacancy-related colour centres in the industry’s leading 3rd generation semiconductor – silicon carbide (SiC) – to overcome one of today’s main challenges in quantum technology: the lack of fab-ready and CMOS-inspired quantum device fabrication techniques. SiCqurTech will integrate colour centres in silicon carbide photonic chips and benchmark their performance for application in quantum communication networks. To this end, SiCqurTech brings together an interdisciplinary European consortium that will: (1) explore the growth of novel quantum-grade silicon-carbide material with controlled isotopic concentrations; (2) develop a fab-compatible silicon-carbide-on-insulator technology and electrical control structures via high-throughput sample characterisation; (3) investigate industry-compatible surface modification techniques to further improve the spin-optical coherence of colour centres; (4) demonstrate multi-qubit control and photon-mediated entanglement.

SiC platform for quantum device fabrication

- nanophotonic circuitry
- on-chip colour centre tuning (pin/Schottky diodes)
- control of electron-nuclear spin qubits
- spin-photon entanglement generation

Key challenge

Quantum device fabrication using “Fab-ready” methods inspired by CMOS technology



QuTech

Dr. Tim Taminiau

- Development of the spin-qubit control and readout.
- Support the photon-mediated entanglement between spin qubits.
- Support the development of SiC with controlled isotopic concentrations through characterisation.

LUXEMBOURG
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LIST

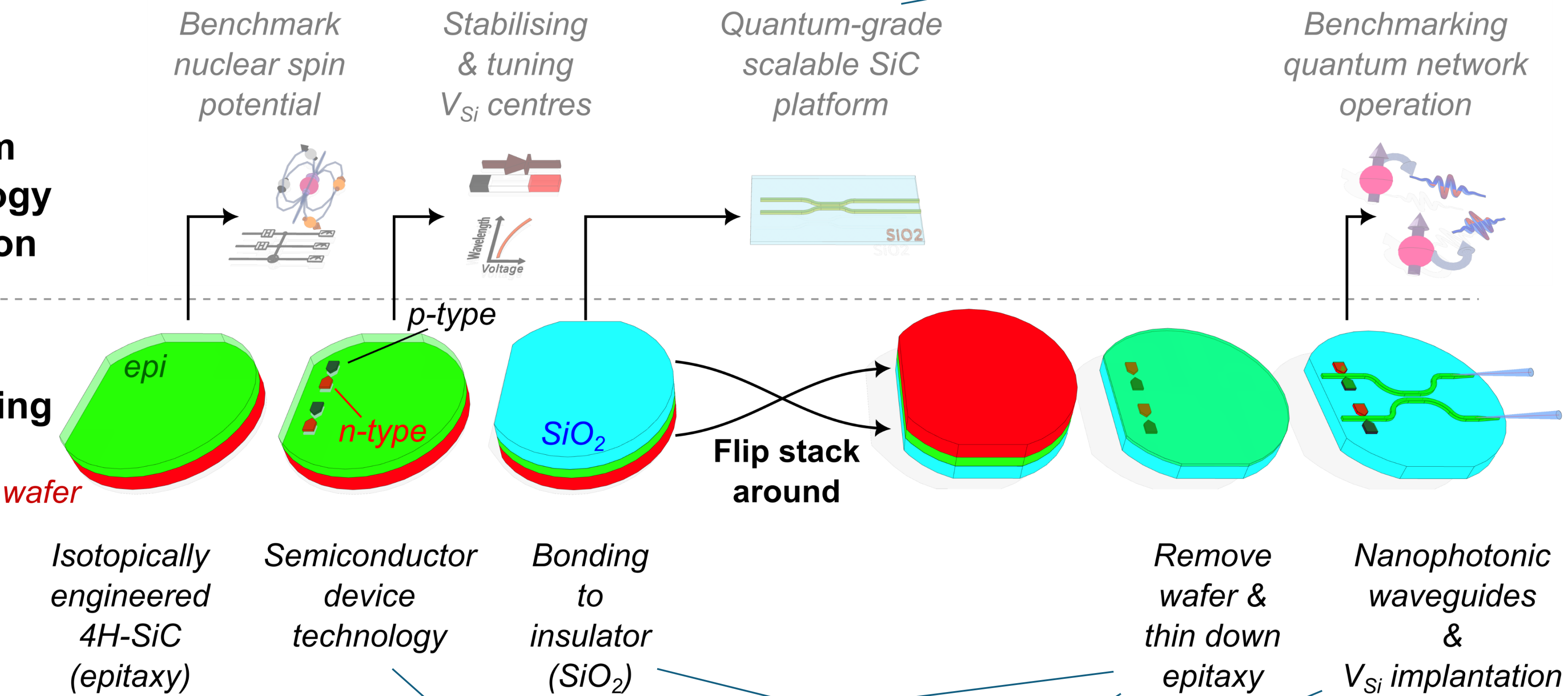


Dr. Florian Kaiser

- Experimental development of a high-throughput cryo-optic measurement station for surface passivation and SiC-on-insulator.
- Photon-mediated entanglement generation between colour centres on a SiC chip.

Quantum technology evaluation

SiC processing step



Li.U LINKÖPING
UNIVERSITY
Prof. Jawad Ul Hassan

- Growth of quantum grade isotopically pure 4H-²⁸Si¹²C.
- Development of a novel 4H-SiC material with controlled isotopic engineering of ²⁸Si, ²⁹Si, ¹²C, and ¹³C.
- Development of a new method to achieve quantum grade SiC-on-insulator through electrochemical etching.



Friedrich-Alexander-Universität
Department Elektrotechnik-
Elektronik-Informationstechnik

Dr. Julietta Förthner, Prof. Jörg Schulze

- Design, device technology, and characterisation of electronic components for SiC quantum photonic integrated circuits.
- Formation of colour centres by ion implantation.
- Wavelength stabilisation and charge control of colour centres.

ETH zürich

Prof. Ulrike Grossner

- Development of an initial surface passivation enabling low-noise spectrally stable V_{Si} centres within 1D waveguides suitable for SiC-on-insulator bonding.
- Support the transfer and scaling of novel insulator layers towards industrial scale application.
- Develop a link between traditional opto-electronic SiC-insulator characterisation techniques with the high-throughput cryo-optic measurements developed by LIST.

