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FRAUNHOFER INSTITUTE FOR INTEGRATED SYSTEMS AND DEVICE TECHNOLOGY

1 View into horizontal hot-wall reactor for SiC homoepitaxy during wafer loading. Image: Kurt Fuchs / Fraunhofer IISB

SiC MATERIALS

CUSTOM-TAILORED SUBSTRATES AND EPILAYERS

Our objectives

- Provide custom-tailored material with quality beyond state of the art
- Support of customers' process and material development

Features

- Advanced homoepitaxial growth of high-quality epilayers in R&D hot-wall reactor
- Simulation of fluid dynamics, heat transfer, species transport, and chemical reactions with tailored CFD software
- Awarded defect analysis in substrates, epilayers, and devices

Advantages

- One-stop solution from epitaxy to characterization, simulation, and device processing
- Focused approach in materials development based on device and system expertise
- Awarded scientific expertise in epitaxy and characterization

Benefits

- Small-scale production of high-quality material at attractive costs
- Custom-tailored defect analysis along the value chain
- One-stop solution for supporting customers' process and materials development

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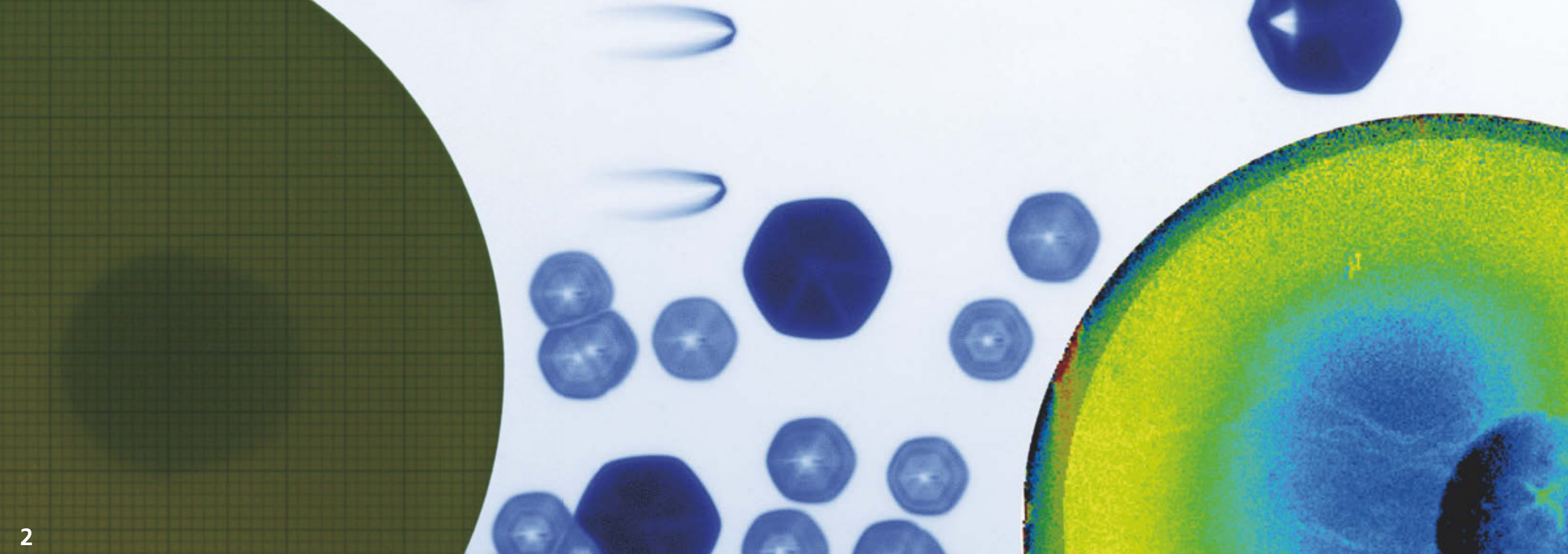

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FRAUNHOFER IISB OFFERS R&D SERVICES ON SiC FROM MATERIALS DEVELOPMENT AND PROTOTYPE DEVICES TO MODULE ASSEMBLY AND MECHATRONIC SYSTEMS.

Homoepitaxial growth

- n- and p-type epilayers with wide doping range
- High-quality, thick epilayers suitable, e.g., for bipolar device production due to low BPD density
- Thin epilayers (< 1 µm)
- Overgrowth of implanted layers
- Growth on Si- and C-face
- Growth on low off-cut substrates

2 SiC substrate, dislocation-correlated etch pits, and colour-coded minority carrier lifetime mapping of homoepitaxial layer. Image: Fraunhofer IISB

Materials characterization

- Identification and quantification of structural defects in substrates and epilayers by Defect Selective Etching (DSE), Synchrotron X-ray Topography (SXRT)
- Investigation of defect evolution from substrate to epilayer and device
- Structural defects as recombination centers: minority carrier lifetime (µ-PCD method), electron-beam induced current (EBIC) and Photo Luminescence (PL) imaging
- Surface morphology and determination of surface roughness by Atomic Force Microscopy (AFM) and optical microscopy
- Electrical properties of epilayers by Capacitance-Voltage (CV) measurements

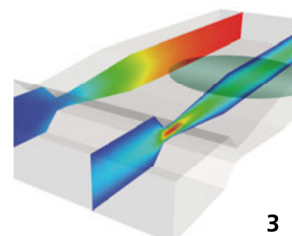
Re-engineering of devices

- Identification and quantification of structural defects in devices
- Correlation of structural defects to electrical characteristics of devices
- Failure analysis of devices

Process simulation

- Tailored CFD software solutions using OpenFOAM® and ANSYS®
- Fluid dynamics and heat transfer for bulk and epitaxial growth processes
- Species transport with chemical reactions in CVD processes

3 Simulation of chemical reactions in CVD process: Deposition profile of SiC (left) and flow velocity within flow channel (right). Image: Fraunhofer IISB



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