Fraunhofer IISB

Fraunhofer Institute for Integrated Systems and Device Technology IISB

Spectroscopy and Test Devices

Electrical characterization of customized test devices at the wafer level and detailed electrical defect spectroscopy for small-scale samples

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Electrical characterization at wafer probe station
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The variability of semiconductor substrates for applications in power and communication electronics has been rapidly increasing in recent years. In this context, compound semiconductors play a significant role. These materials exhibit physical properties that surpass those of established silicon for these applications. Moreover, defects in these materials are candidates for the realization of individual quantum states for future highly sensitive quantum sensors or ultra-high-performance quantum computers.

Based on a comprehensive defect-spectroscopic characterization of semiconductor materials (notably GaN, SiC, AlGaN, AlN, GaAs, and InP), test devices can be produced and characterized at an early stage of material development in partnership with the Institute of Applied Physics at TU Bergakademie Freiberg. This facilitates a systematic correlation between material properties and the resulting device characteristics, as well as the identification of defects critical to the devices.

We provide extensive expertise in characterizing the electrical properties of various crystal and wafer materials, as well as partially and fully processed devices. This enables us to perform service measurements with a short turnaround time for our clients. Additionally, we leverage this toolkit, particularly the capability to fabricate various test devices, to identify critical defects affecting the performance and reliability of the components, understand their origins, and collaborate with our clients to find solutions to mitigate these critical defects.

Electrical characterization and spectroscopy

Key Topics

Semiconductor material characterization, especially electrical defect spectroscopy of crystals and epitaxial layers using:

- Current-voltage and capacitance-voltage curves (IV/CV)
- Deep Level Transient Spectroscopy (DLTS) and related methods

Device contacting via bonding wire © Daniel Karmann / Fraunhofer IISB

Semiconductor test devices

Services

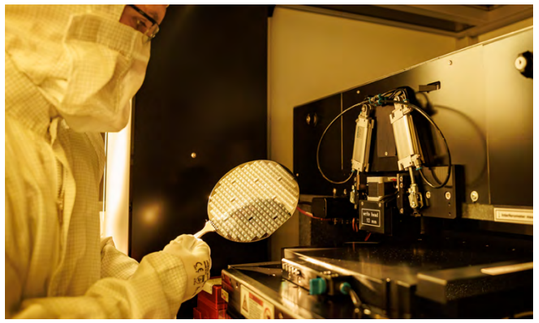
- Development of device processing steps (ALD, ALE, passivation, etching, metallization)
- Single process evaluation using various test devices
- Support for single process technology development
- Customized design of test devices
- Identification of device-critical defects and their correlation to device properties and device characterization
- Electrical characterization of devices at wafer level by IV, CV measurements and determination of interface traps

Key Topics

- Wide-Bandgap (WBG) / Ultrawide-Bandgap (UWBG) based (test)devices
- Atomic layer processing: Atomic Layer Deposition (ALD) and Atomic Layer Etching (ALE)
- Device characterization using current-voltage and capacitance-voltage curves (IV/CV), as well as interface defects (Dit) and deep-level defects in the bandgap using Deep Level Transient Spectroscopy (DLTS) and related methods

Structuring at ALD/CVD - Deposition / ALE Etching Cluster © Daniel Karmann / Fraunhofer IISB

Optical characterization using a spectroscopic ellipsometer © Daniel Karmann / Fraunhofer IISB



Transfer of the structure mask by laser lithography © Daniel Karmann / Fraunhofer IISB

Electrical characterization at wafer probe station using parameter analyzer © Daniel Karmann / Fraunhofer IISB