Fraunhofer ENAS

Service offering

Testing, Characterization and Reliability

Overview

Fraunhofer ENAS is a research and development partner in the field of testing and reliability assessment of microelectronic components and systems. From design, modelling and simulation, test methods and end-of-life predictions to data-based models, the institute supports customers with comprehensive solutions for their complex challenges and accompanies them through the entire transfer process to the market ('lab-to-fab').

The research and development services include:

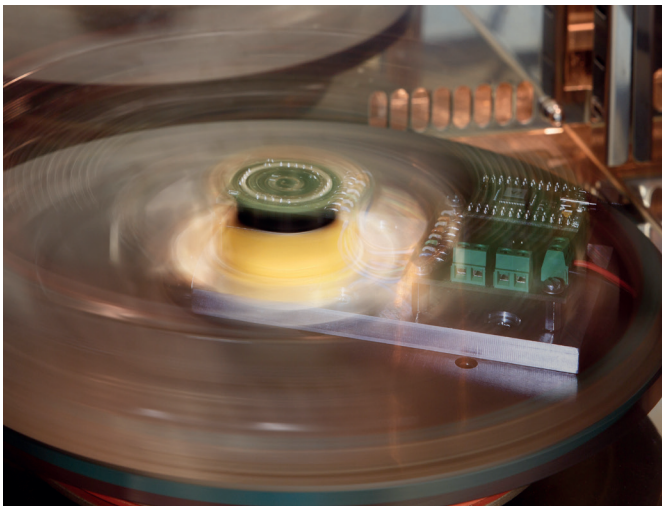
- Tests at wafer, chip, and component level
- Characterization
- Reliability assessment
- Data analysis

Tests at wafer, chip, and component level

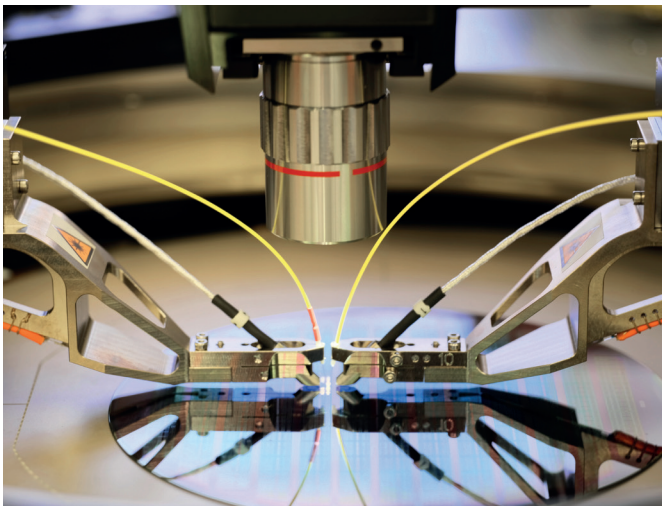
- Electrical tests (functional, burn-in, and performance tests) with automatic wafer probers
- Optical tests using an optical probe station for photonic integrated circuits
- Magnetic tests for MRAM and magnetic sensors
- MEMS tests (C, V, I, f_0, Q, specific parameters) and motion analysis for MEMS (also under vacuum)
- High frequency tests up to 110 GHz
- Acoustic tests for micromechanical ultrasonic transducers (MUTs) and acoustic components
- Near-field measurements for EMC and error tracing
- High-power tests

Characterization

- Inline measurement techniques
  - Scanning electron microscopy (EDX/SEM, FIB/SEM, EBSD/SEM, CD-SEM, microsection preparation)
  - Atomic force microscopy (tapping, deep trench, CD, profiling, KPFM, SNOM, fluidic actuation [Fluid-FM])
  - Inspection (pattern and wafer defect detection, particle inspection)
  - Microscopy methods (optical wide field, laser scanning, confocal, IR, ultrasound)
  - Wafer geometry (BOW, TTV, WARP)
  - Profilometry (optical and tactile, planar 3D microscopy, nanoscale scans)
  - Layer characterization (sheet resistance, ellipsometry, reflectometry)
  - Characterization of bond strength (micro-chevron and compression shear test)
  - Characterization of hermeticity (helium leak test)



Characterization of a rotation rate sensor on the rotary table.



Wafer characterization at the Silicon Photonics Probe Station.

- Offline measurement techniques
  - Spectroscopy (time-resolved FTIR measurements, fluorescence spectroscopy [spatially and time-resolved], confocal microscopy, ultraviolet spectroscopy, Raman spectroscopy, TGA/DSC+FTIR, µWave spectroscopy up to 50 GHz)
  - Optical characterization of light sources (radiometric and photometric measurements, DC, AC, and transient characterizations)
  - Characterization of inertial sensors (tumble test and rotation rate via temperature, vibration, high-g)
  - Characterization of liquids (density, viscosity, particle sedimentation, pH value determination, contact angle measurements, cyclovoltametry, impedance measurements, rheometry)
  - HF characterization (antenna test chamber, vector network analysers, power amplifiers)
  - Laser Doppler vibrometry (3D, infrared)

Reliability assessment

- Accelerated lifetime tests with mixed loads
- Environmental tests (humidity, degradation)
- Long-term climate and load tests under realistic conditions
- Deformation analysis
- Thermoelectromechanical resistance (HT, (H)TC, APC)
- Mechanical stress (tension, compression, shear, bending, scratching, vibration, shock)
- Nano-fatigue and membrane tests

Data analysis

- AI-based segmentation, object detection, and classification in measurement images
- Evaluation (e.g. anomaly detection and feature extraction) of time series data
- Prediction of test and measurement results using complex data-based models
- Integration of expert and physical knowledge for more robust and reliable models with low data availability

In cooperation with

Fraunhofer ENAS is part of

Forschungsfabrik Mikroelektronik Deutschland

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