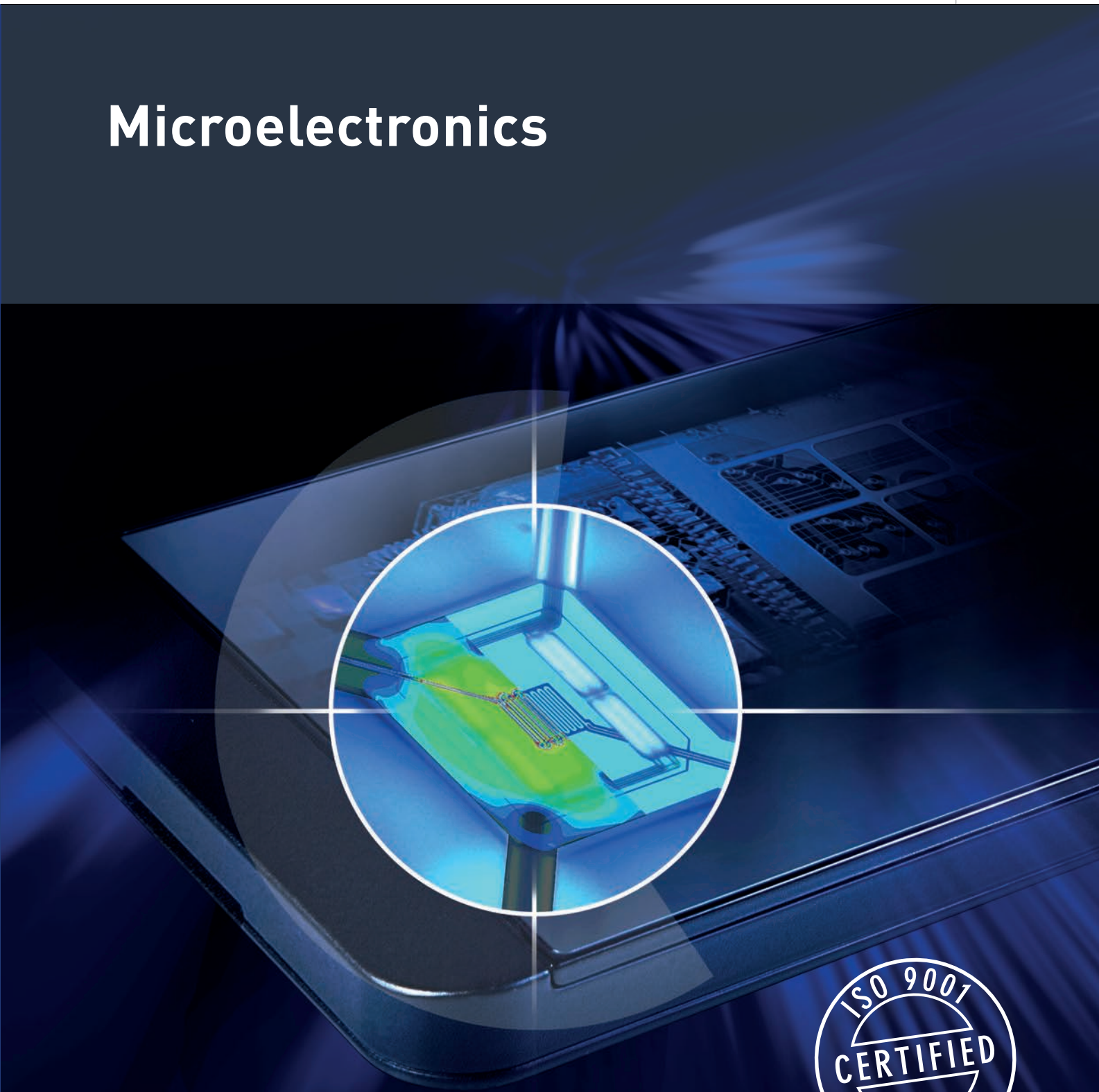
MATERIALS CENTER LEOBEN
FORSCHUNG GMBH

We Innovate Materials

Microelectronics



ISO 9001 CERTIFIED ISO 9001

EXPERTISE & RELIABILITY

Microelectronics

We Innovate Materials

The Materials Center Leoben (MCL) is one of the leading research companies in Austria, working in the field of materials research and technology. Starting with research on metals, today MCL works with more than 150 highly qualified employees in all materials classes and in various application areas on material-based innovations. The research program is focused on the integrated simulation along the entire value chain, from material synthesis and processing through to in-service behaviour, including design of materials and applications.

The division „Materials for Microelectronics“ is focused on material based solutions for the microelectronics industry and has a wide-range of expertise in material characterisation as well as numerical simulation of materials-, processes- and components at all length scales at its disposal.

The division of „Materials for Microelectronics“ is focused on::

- 3D Integration and Packaging
- Materials for sensor technology, compatible with CMOS
- Simulation-based „Design for Reliability“ and „Co-Design“
- Services for material characterisation and reliability analysis

EXPERTISE AND HIGH-TECH EQUIPMENT

FOR YOUR SUCCESS

Roads to miniaturisation: Sensor-development for the consumer-market

Development of miniaturised sensor-systems
Nano technology based sensors that are integrated on CMOS based electronics devices offer new possibilities in gas sensing for consumer applications.
To this end metal oxide nanowires are functionalized in order to become more sensitive to various gases.

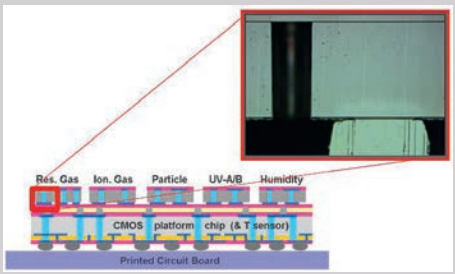
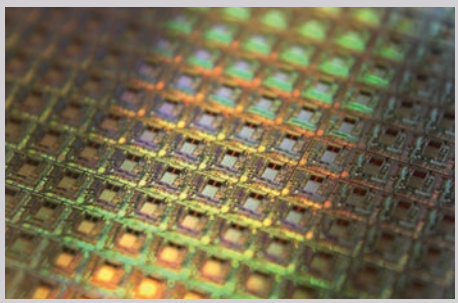


Photo: ams AG

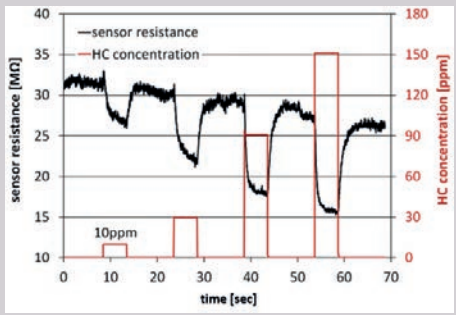
Profile of the structure of a 3D integrated CMOS-system

CMOS-based sensors
Together with company partners such as ams AG and EVGroup an innovative process chain is developed to apply nanowires and nanoparticles on CMOS-wafers to transpose the distinguished properties of nano-components in gas-sensor-technology, concerning both technical and economic aspects.



CMOS-wafer

High-sensitive sensors by use of nanowires
Within the scope of international projects MCL is working with its partners to develop new sensor systems and production technologies, which should enable a flexible „Plug-and-play" 3D-integration of nanosensors and nanotechnological components on CMOS-chips, to produce high-sensitive sensors, which are equally capable for bulk production.



Test signal of a gas sensor for different gas concentrations (HC)

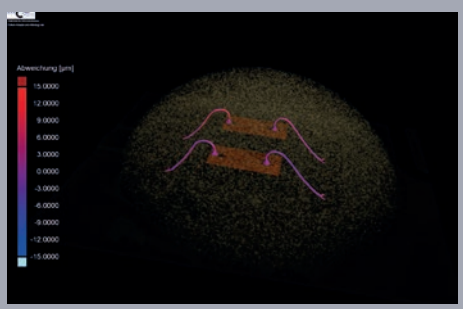
Impact
Sensors for environmental monitoring, in order to warn people from the existence of hazardous gases such as ozone, carbon monoxide or from high fine dust contents in the air.

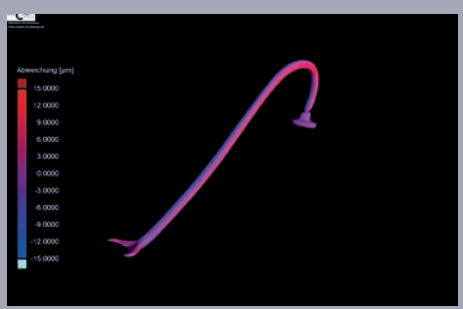
More power in LED lighting technology

In-situ-characterisation of white-light LED modules by CT

The application of light-emitting diodes (LED's) is fast growing mainly because of their high efficiency compared to classical filament lamps.

But there are still some challenges to overcome. Development goals are to further increase the illumination density and the efficiency while ensuring a high colour quality and life time of LED modules. Thermal- and thermo-mechanical management of LED modules is one of the solution paths to meet these goals.

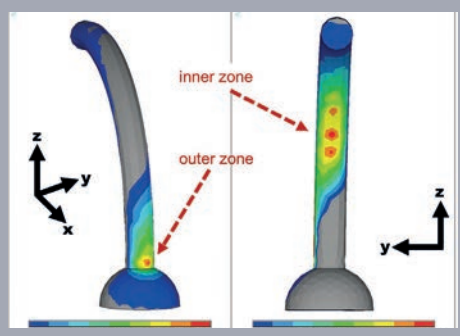




CT-pictures from a LED-module: The image above shows a CT image of the light emitting area of a white-light LED-module; on the image below a magnified section of a wire is shown. The colours indicate the displacement of the wire with increasing temperature

Simulation of thermo-mechanical loads of LED-modules

Together with Tridonic Jennersdorf GmbH the Materials Center Leoben investigates thermo-mechanical problems in white-light LED modules applying experimental methods as well as numerical simulations. The goal is to increase the lifetime of LED modules. A new method was developed, which allows recording and analysis of images made with computed tomography (CT-images) as a function of temperature. The combination of both, CT-analysis and thermo-mechanical simulation, enables a detection of stress localisations in the module which provides a valuable basis for module optimization.

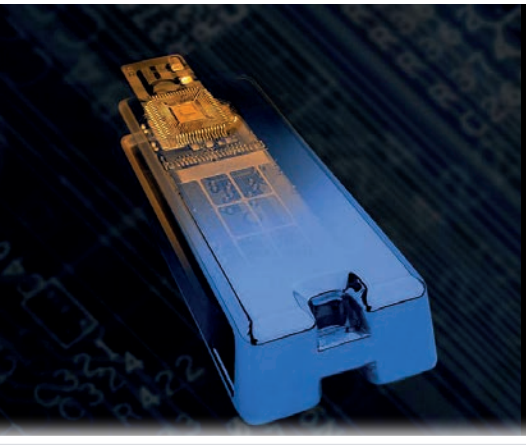
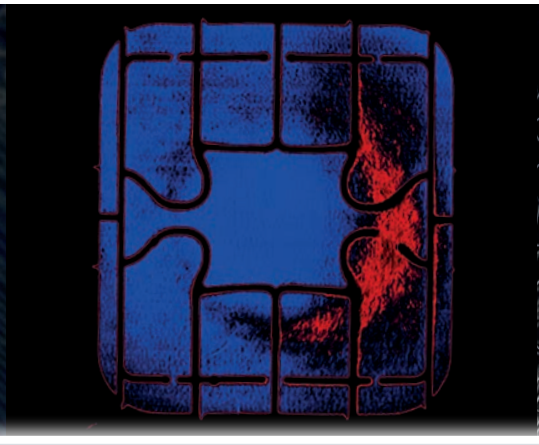
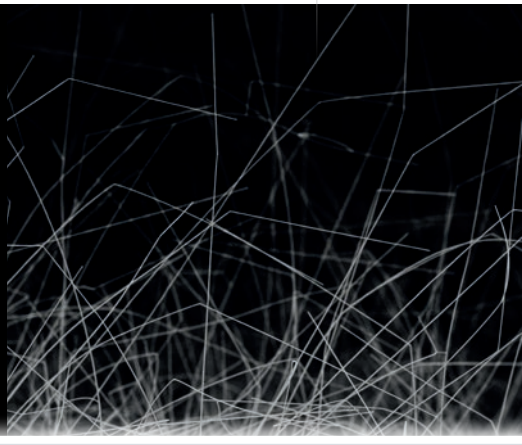


The image shows critical stress areas in the region of a wire-contact-transition point

Impact

The results are used for further development of the applied materials and the optimisation of the design of the components that contributes to lifetime enhancement of LEDs.

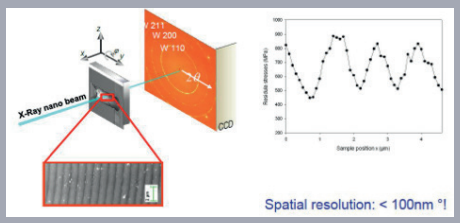
RANGE OF SERVICES
AND EQUIPMENT

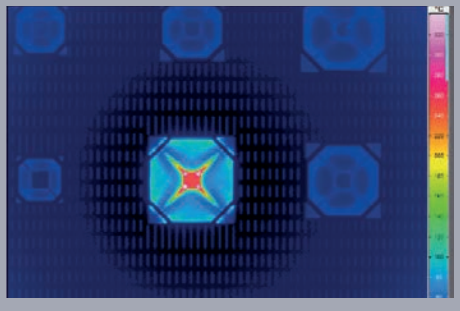




MCL – Laboratory of microelectronics:

MCL has an extensive range of characterisation methods and expertise in process technology for manufacturing electronic components at its disposal.

MCL offers a variety of testing methods to characterise the durability of electronic components. The focus lies on identifying the thermal, electrical and mechanical properties of components and their constituent materials. With the aid of advanced numerical simulation, we close the circle between function assessment, reliability assessment and predictive reliability analysis.





Our technical equipment in the laboratory of microelectronics:

- High-resolution Computed Tomography (Nanotom M from GE) with equipment for heating, cooling and mechanical loading
- Ultrasonic microscope (SAM 400 PVATEPLA) with equipment for mechanical loading
- Dynamic-mechanical-analysis (RSA G2 from TA) with a tempering unit (-70 to 500°C)
- REM/FIB workstation (Auriga von Zeiss) with EBSD and EDX
- Scanning Probe Microscope (BRR from DME) to be used in connection with the REM/FIB workstation
- Thermal-Impedance measuring system (T3Ster from Mentor Graphics) including TeraLED modules and Flowtherm
- Point probe station, DC and AC supply and parameter analysis
- Differential-scanning-calorimetry (DSC8000 from Perkin Elmer)
- UV-VIS spectrometer (Lamda 650 form Perkin Elmer)
- Infrared spectrometer (Avatar 320 from Nicolett)
- Spray-pyrolysis-facilities
- Gas sensors test station
- Target preparation (TXP from Leica) and light microscopy
- In Cooperation:
  - Lithography (e-Beam and Licht), etch procedures, coating facilities
  - Nanoindenter (Agilent Nanoindenter G200 from Keysight Technologies)

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