

CAM IS A COMPETENCE CENTER FOR  
MICROSTRUCTURE DIAGNOSTICS  
AND MATERIAL CHARACTERIZATION  
WITHIN FRAUNHOFER IMWS IN HALLE

## CENTER FOR APPLIED MICRO- STRUCTURE DIAGNOSTICS

The Center for Applied Microstructure Diagnostics is a leading service provider for failure diagnostics and materials assessment. Contract R & D for industry, semiconductor technologies, microelectronic components, microsystems and nanostructured materials is our day-to-day business.

At CAM, we cover the entire work flow from non-destructive defect localization over high precision target preparation to cutting edge nanoanalytics supplemented by micro-mechanical testing, finite element modelling and numerical simulation. In preparation for future challenges, we do accomplish intense forefront research in cooperation with international partners.

## CONTACT US

Prof. Dr. Thomas Höche  
Center for Applied Microstructure Diagnostics  
Fraunhofer IMWS  
Heideallee 19 (office) | Walter-Huelse-Strasse 1 (mail)  
06120 Halle, Germany

Phone +49 (0) 345 5589-197  
thomas.hoeche@imws.fraunhofer.de  
www.cam.fraunhofer.de

## MAJOR APPLICATIONS

### Electronics and microsystem technologies:

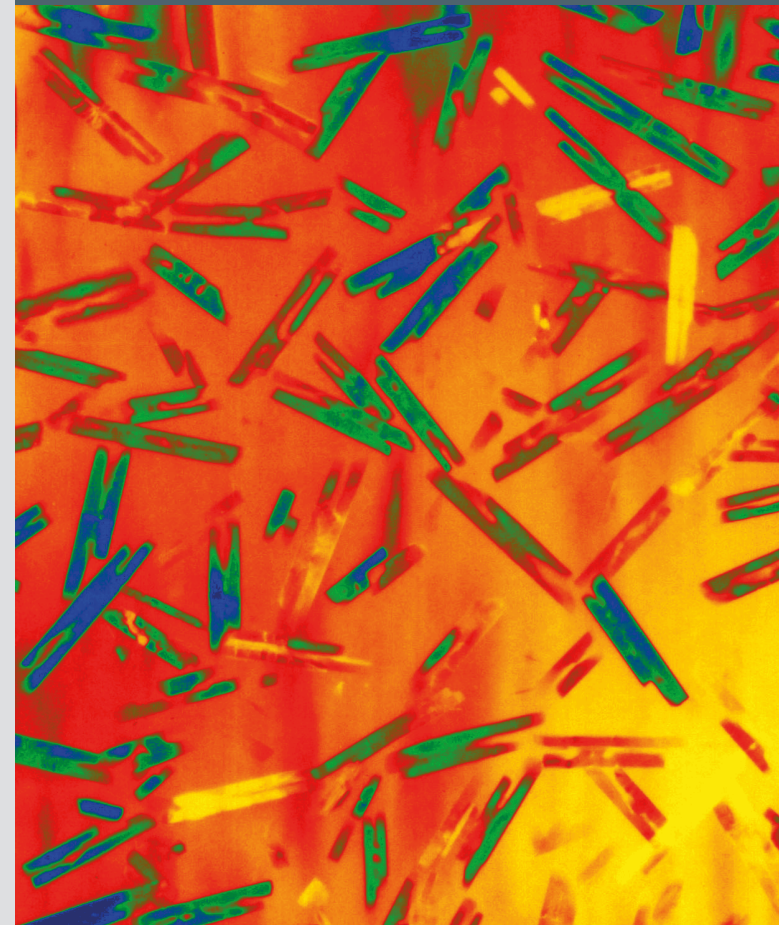
- Si-based semiconductor IC technologies (CMOS, BiCMOS, HV CMOS)
- Optoelectronics and HF electronics
- Power electronics
- Organic electronics
- Microelectronics packaging
- Advanced 3D System Integration
- Interconnecting materials for photovoltaics (cooperation with Fraunhofer CSP)
- MEMS and actuators
- Sensor materials

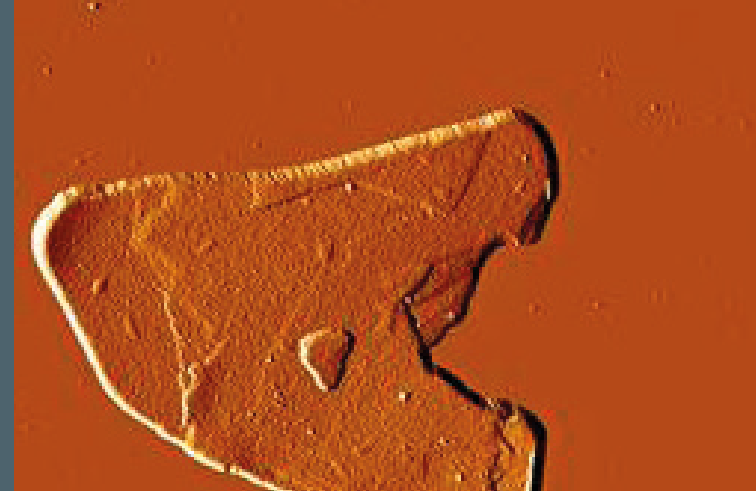
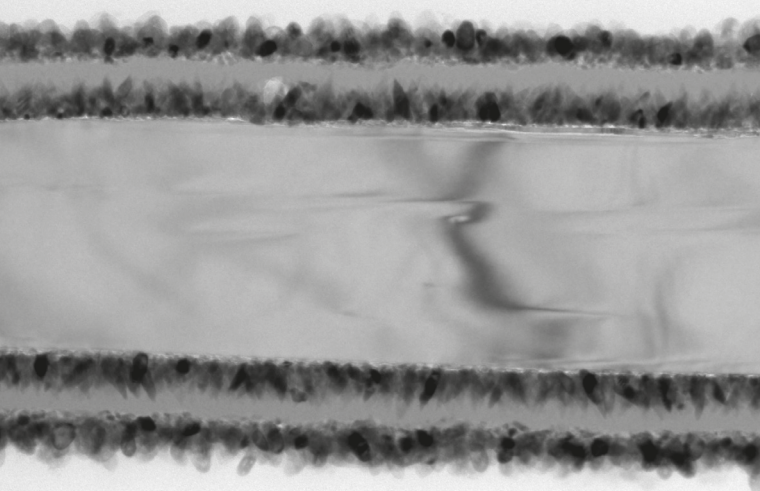
### Nanotechnologies:

- Pigments and nanoparticles
- Optical coatings
- Nanostructured glasses, ceramics and glass ceramics
- Selected health care materials

FRAUNHOFER IMWS  
CENTER FOR APPLIED MICROSTRUCTURE DIAGNOSTICS

## PIGMENTS AND NANOPARTICLES





## PIGMENTS AND NANOPARTICLES

Industrial coating systems are highly sophisticated masterpieces of engineering. Being used in automotive, printing, cosmetics, branding, or as a safety feature against forgery or for product traceability, nanoparticle and pigments combine optical functionality with improved physical properties. For optical appearance, pigments are key to design that makes a difference.

Brilliant and unique colors as well as luster effects in combination with the required multi-functionality of coating systems require profound knowledge about the microstructure-property relationship of (coated) pigments and other additives. Color fastness, function robustness, and durability against environmental influences are crucial.

At CAM, we hold available all necessary equipment and expertise to investigate the microstructure and chemistry of coating systems, pigments, and nanoparticle down to the atomic scale. We are specialized in skillfully accomplishing the difficult, targeted, and artifact-free preparation required to both study individual pigment particles and single defects in coating systems.

## OUR SERVICES

- Dedicated target preparation (mechanical or based on focused/broad ion beams)
- Scanning electron microscopic (SEM) imaging/chemical analyses of cross-sections and surfaces
- In-situ SEM characterization close to environmental conditions
- Texture analysis and determination of orientation distributions
- Atomic-resolution imaging and chemical analyses at (coated) particles
- Chemical (trace) analyses using a multitude of spectroscopic techniques
- Mechanical properties of individual pigments and coating systems
- Determination of surface topography on the micro- and nanoscale
- Electric characterization of functional coatings
- Registration and assessment of particle positions in coating systems
- Failure analyses in coating systems

## EQUIPMENT

- Non-destructive 2D X-Ray inspection and 3D tomography
- Confocal laser scanning microscope
- Lock-in-Thermography including phase shift analysis software for 3D localization
- Comprehensive mechanical preparation
- Time of flight secondary ion mass spectrometry (TOF-SIMS)
- X-ray photoelectron spectroscopy (XPS)
- Combined laser and FIB milling
- High current Ga-FIB
- High current Xe-Plasma-FIB
- Combined FIB/SEM tools
- High resolution TEM with EDX, EELS, and EFTEM (FEI Titan<sup>3</sup> G2 80-300 [image corrector, high-brightness gun, SuperX detector], FEI Technai F20)
- High-resolution SEM with EDX and EBSD analytics
- Environmental scanning electron microscopy ESEM / in situ techniques
- Scanning probe microscopes (SPM, AFM)
- Nano indenter and other mechanical tests facilities including simulation
- IR-Spectroscopy