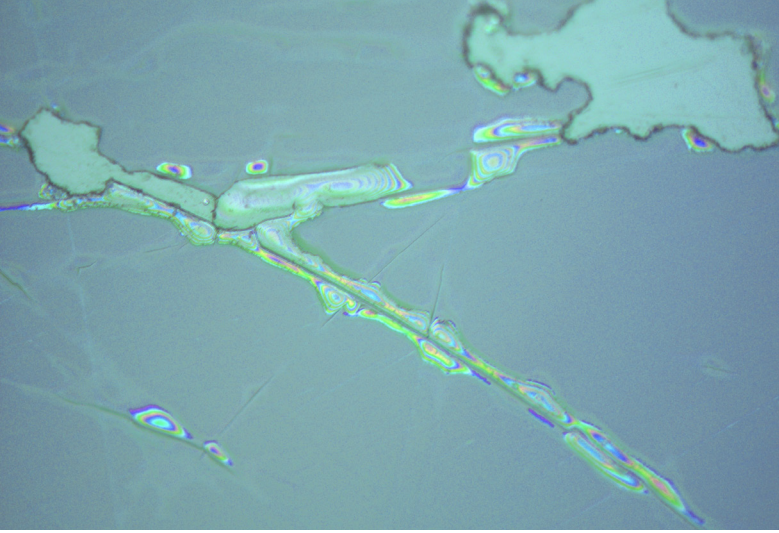


Fraunhofer
IMWS

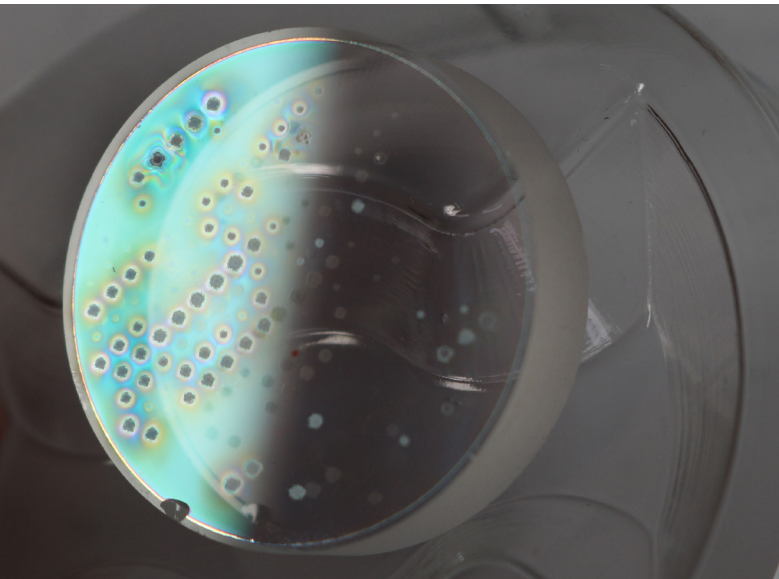
Fraunhofer Institute for Microstructure of Materials and Systems IMWS

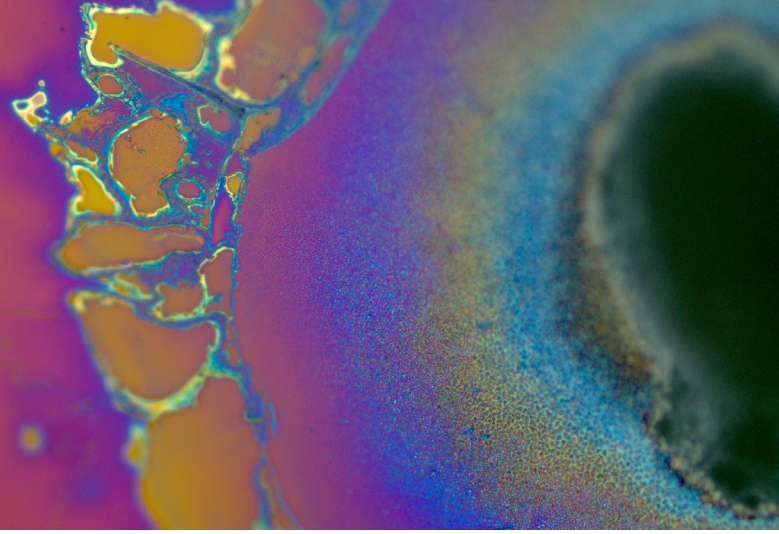
Business Unit
Optical Materials and Technologies

Thin Film Diagnostics



Coating Control





What went wrong here?

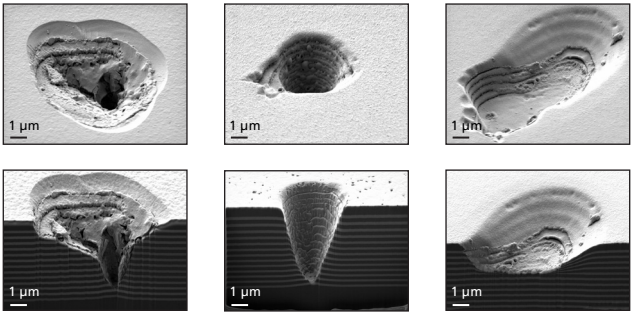
Ask us! We offer:

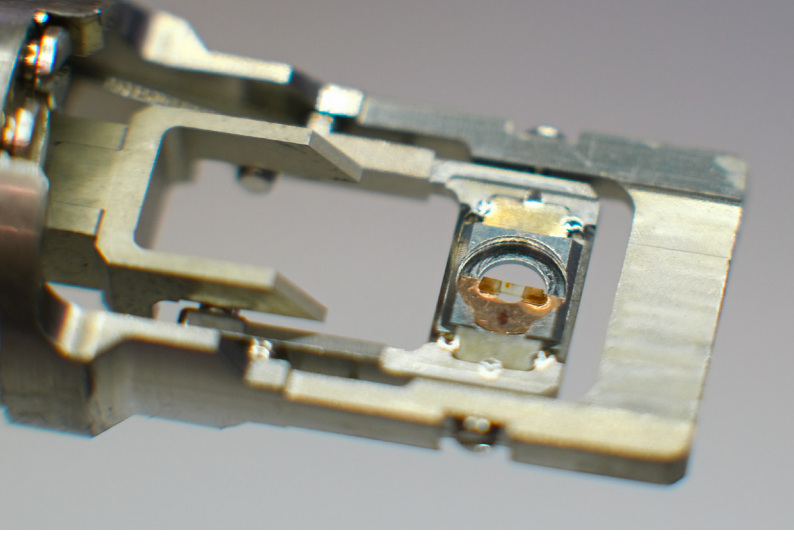
- Broad experience through close cooperations with manufacturers of thin optical coatings / thin-film based optical components
- Next level failure analysis: microstructure-based process insights reduce development times
- Long-standing expertise in diagnostics of coating systems and substrates down to the sub-nanometer scale
- Artifact-free sample preparation and high-resolution analysis of thin-film based optical coatings from EUV to IR



SEM-FIB

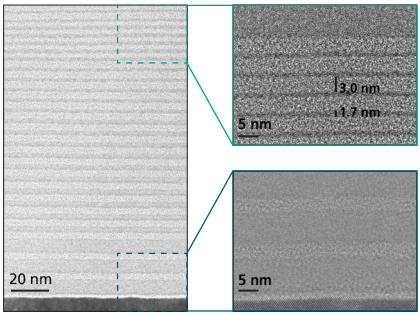
- Surface imaging using scanning electron microscopy
- Targeted cross-sectioning (with a target precision of a few nm) via focused ion beams (FIB) with sub-sequent cross section imaging for failure analysis
- Chemical analysis using energy-dispersive X-ray spectroscopy (EDS)

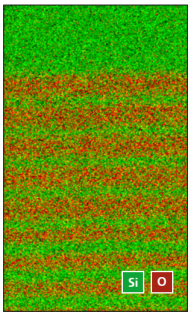


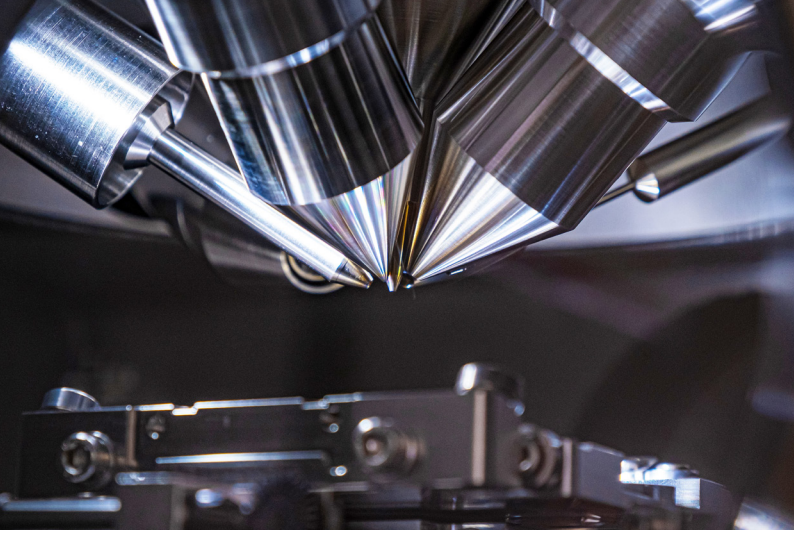


HR-TEM

- Preparation of transmission electron microscopy cross section samples with subsequent high-resolution imaging (point-to-point resolution: 0.04 nm)
- Information about crystallinity, homogeneity and interface roughness of thin layers
- Chemical analysis via energy-dispersive X-ray spectroscopy (EDS) and electron energy-loss spectroscopy (EELS) with sub-nm resolution

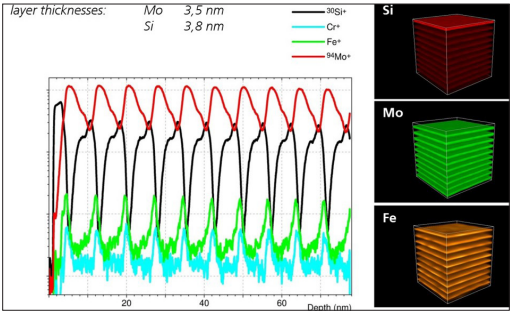


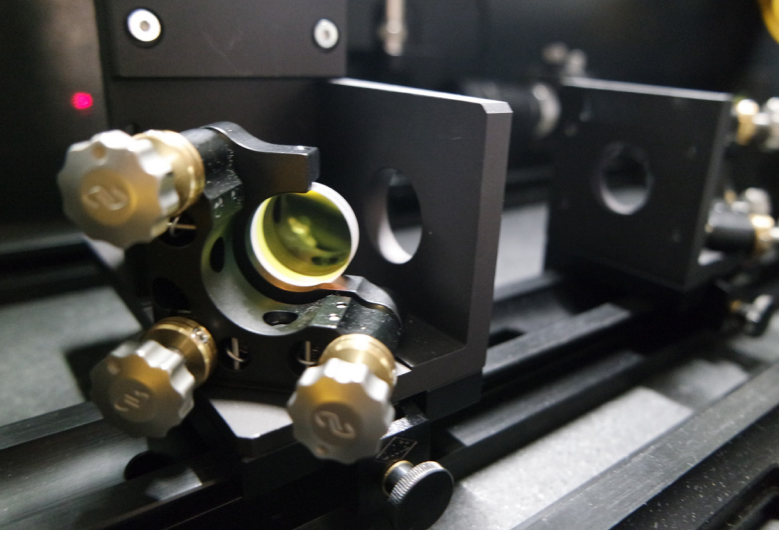




ToF-SIMS

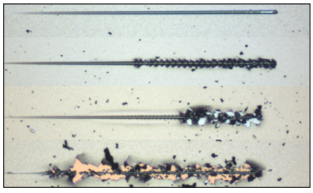
- Elemental and molecular composition of a surface with detection sensitivity in the ppm-ppb region
- Bulk information by depth profiling of organics using different sputtering ion beams
- Lateral resolution < 100 nm, depth resolution ~ nm
- Gas cluster ion beam (depth profiling of organic materials) and cryo options

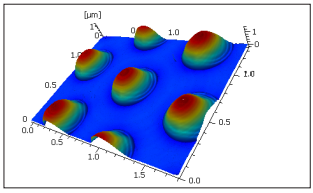




Further methods

- Estimation of fracture / adhesive strength and mechanical properties of thin films using (nano-) indentation and scratching
- Standard-free quantification, chemical bonding and valency information using XPS, depth profiling with GCIB option
- Various optical inspection lamps and microscopy setups to visualize defects, contaminations or scattering particles
- Further, complementary techniques (e.g. AFM, FTIR, ICP-MS) available







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