CHARACTERIZATION OF THIN FILMS AND SURFACES
SERVICE FOR RESEARCH, DEVELOPMENT AND QUALITY CONTROL
Characterization of thin films and surfaces

The department materials analysis at Fraunhofer FEP has versatile methods for characterization of thin films and surfaces. The equipment and the wide analytical experience of our staff are available for the product and technology development of our institute and are offered as a service to our customers. Typical applications areas are layers for optics, sensor technology, displays, photovoltaic, packaging, corrosion and wear resistance.

Structure and microstructure

Cross fracture and surface of a molybdenum layer (Topographic contrast)

Emitter layer of a polycrystalline silicon solar cell (Voltage contrast)

Ion polished cross section of a permeation barrier layer system (Material contrast)

Ion polished cross section of a CdTe solar cell (Crystal orientation contrast)

Metallographic cross section of a copper layer

Metallographic cross section of a magnesium-zinc alloy layer

Ultra high resolution FE scanning electron microscope, SU8000 (Hitachi)

Ion preparation technique for cross sections, Cross Section Polisher, SM-09010 (JEOL)

Metallographic preparation technique and optical microscope Polyvar 2 Met (Reichert)
Topography

Surface of a FTO layer with typical crystallite morphology

Atomic force microscope (AFM) Explorer (Topometrix)

Surface of a (Ti,Nb)Ox layer with spherulitic crystallites

Surface profiler P15-LS (TENCOR)

Roughness scan of a steel sheet

Stress determination of thin layers from curvature

Chemical composition

EDS spectrum of a BNxOyCz layer

Energy-dispersive X-ray spectroscopy (EDS)
SDD detector Apollo XV (EDAX)

EDS element mapping of gilded silver threads with Ag5S corrosion layer

Glow discharge optical emission spectroscopy (GD-OES)
GDS-750 QDP (Leco)

Chemical depth profile of a CdTe thin film solar cell

Chemical depth profile of a optical rugate filter
Layer properties

**Optical**
- spectroscopic ellipsometry (SE850, Sentech)
- UV VIS spectroscopy (Lambda 950, Perkin Elmer)
- haze measurement (Haze-guard plus, BYK-Gardner)

**Mechanical**
- hardness and indentation modulus (Nano Indenter XP, MTS)
- abrasion resistance (Taber Abraser)
- scratch adhesion test (MST4, CSEM)
- layer thickness (Calotest, CSEM)

**Electrical**
- I-V curve of solar cells (Sun 300, LOT)
- quantum efficiency (Oriel IQE-200, Newport)
- photo and dark conductivity (SUSS Prober und Keithley)
- electrical four point probe (FPP 5000, Veeco)

**Permeation barrier**
- water vapour permeability (WDDG, Brugger Feinmechanik)
- oxygen permeability (OX-TRAN 2/20, Mocon)

**Corrosion**
- corrosion test system for condensation water test and salt spray test (SKB 400 A-SC, Liebisch)

**Environmental**
- environmental chamber -40...+150°C; adjustable humidity (SH-241, ESPEC)

---

**TITLE PHOTO**

FE scanning electron microscope
SU8000 (Hitachi)
1 Metallographic preparation technique (Struers)
2 Optical microscope
Polyvar 2 Met (Reichert)
3 Atomic force microscope
Explorer (Topometrix)
4 Surface profiler P15-LS (TENCOR)
5 Glow discharge optical emission spectrometer GDS-750 (Leco)
6 Spectroscopic ellipsometer SE850 (Sentech)
7 Nano Indenter XP (MTS)
Our offer

- analytical services for analysis of the effect of process parameters on structure and microstructure, topography, chemical composition and properties of thin films
- support of our customers for quality control and failure analysis
- technical advice for selection and combination of suitable analysis methods
- development of analysis methods for specific applications and measurement tasks

8  Water vapour permeability tester (Brugger)
9  Calotest (CSEM)
10  Abrasion resistance (Taber Abraser)
11  Electrical conductivity (SUSS Prober und Keithley)

Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP

Winterbergstr. 28
01277 Dresden, Germany

Contact persons

Dr. Olaf Zywitzki
Phone +49 351 2586-180
olaf.zywitzki@fep.fraunhofer.de

Dr. Thomas Modes
Phone +49 351 2586-183
thomas.modes@fep.fraunhofer.de

www.fep.fraunhofer.de