Fraunhofer ICT

Material characterization and failure analysis

The technical demands on polymer materials are constantly growing, and at the same time secondary raw materials are increasingly being used. Manufacturing processes are being optimized or newly developed. But do new formulations or processes really meet the high demands placed on them?

Plastics testing

Plastics testing provides important information to evaluate materials and compare the quality of materials and finished parts on every level. The material testing laboratory at Fraunhofer ICT is operated by an experienced and independent team and has the laboratory and pilot facilities necessary to perform comprehensive tests on your products or materials. We generate material data for structure and process simulation and, in the event of failure, we offer a systematic analysis.

Above:
4-point bending test of thermoplastic foam sandwich part.

Left:
Series extraction e.g. to determine residual monomer content.

Sample production

Test results can only be used to compare different materials when the sample production and preparation of the materials are identical. In this field Fraunhofer ICT can offer the following production methods:

- Injection molding for thermoplastics and free-flowing thermosets
- Production of sheet material for the manufacturing of test samples by compression molding
- Mechanical separation processes and hot-wire cutting
- Conditioning of samples in climate chambers

Mechanical testing methods

- Tensile test with measurement of the lateral contraction
- Flexural bending test, 3-point and 4-point
- Testing of interlaminar shear strength (e.g. ILSS, tensile shear test, shear-edge test)
- Compression test, e.g. of composite materials or polymer foams
- Impact strength (Charpy) and puncture test
- Heat deflection temperature (HDT) Vicat softening point
- Bond strength tests (e.g. lap-shear test)
- Dynamic-mechanical analysis (DMA)
- Characterization of the deformation behavior of semi-finished products (e.g. tape material or organosheets)

Rheological testing

For the rheological characterization of polymer melts we offer the following tests:

- Shear viscosity (high-pressure capillary viscosimeter)
- Elongational viscosity (Rheotens)
- Rotating/oscillating rheometer (plate-plate or cone-plate)
- Melt index test (MFR/MVR)

Complementary testing methods for plastics

- Determination of the temperature- and pressure-dependent specific volume (pVT measurement)
- Thermal conductivity measurement
- Determination of fiber content
- (annealing residue or wet-chemical)
- Fiber length measurement (glass, carbon, natural fibers)
- Determination of residual monomer content for PA6
- Determination of the moisture content of granulates
- Shore-hardness (Shore A and Shore D)
- Measurement of density (immersion method)
- Color measurement
- Contact angle measurement and surface energy
- Thermal analysis (DSC, TGA, TG-MS)
- Artificial and natural weathering

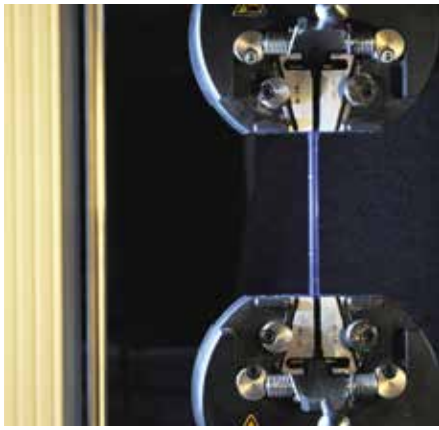
Optical/electron microscopy and preparation techniques

For structural investigations such as:

- Crystallinity of polymers
- Depiction of cavities/pores
- Fiber or particle distribution in polymers
- Blend morphology
- Detection of damage or processing defects
- Layer thickness measurement
- Polymer adhesion, for example to glass fibers

the following equipment is available:

- Electron microscope (SEM) with element analysis (EDX)
- Transmitted-light microscope
- Scanning reflected-light microscope
- Macroscope
- Rotation microtome
- Cryomicrotome
- Grinding and polishing machines to generate polished and thin sections



Determination of tensile properties according to DIN EN ISO 527

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