

Characterization of polymer foams

In addition to material and process development of particle and extrusion foams, we also offer comprehensive characterization of thermoplastic as well as thermoset foams along the entire process chain from raw material to component. The material testing laboratory at Fraunhofer ICT has the laboratory and pilot facilities necessary to generate material data for the evaluation of raw material development or process influences and material data sheets. Through structural examination and material analysis, we achieve a reliable statement on the quality of the finished component.

Analysis of the microstructure

- Optical or electron microscopy of polished sections, break surface and cuts
 - Sample preparation
 - Thin section polishing
 - Nitrogen fractures
 - Microtome section under liquid nitrogen
- Thickness measurement of the cell walls
- Analysis of the cell size and cell geometry

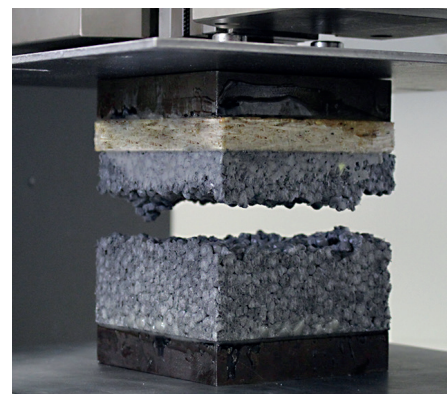
Thermal conductivity

- THB transient-hot-bridge method
 - type Linseis THB1
 - based on DIN EN 993-15:2005
- Guarded hot plate apparatus
 - type λ -meter EP500e
 - according to ISO 8302, EN 1946-2

Mechanical and physical testing

Comprehensive standardized testing methods for generating material data sheets or evaluating process influences:

- Tensile tests with strain measurement and temperature chamber
- Bending tests: 3-point and 4-point
- Compression tests
- Shear tests
- Testing of bond strength of hybrid materials/joint connections/sandwiches
- Impact strength (Charpy) and falling dart
- Compression set test
- Density of particle beads, foamed strands or components with buoyancy method



Top: SEM image of a micro-scaled foam sample

Bottom: Tensile test of sandwich perpendicular to faces

Flammability test

- DIN EN 13501-1 class E (DIN 4102-1 B2-Test) test
 - Flame treatment from: edge or surface
 - Simulation of a match flame
 - Test for building materials
- FMVSS 302 test
 - Test for seating foam for automotive applications
- FAR 25.853 Part I & Part II test
 - Test for aircraft seat cushions
- Limiting oxygen index (LOI) test
- Cone calorimeter measurement
- UL94 test
- Glow wire test



DIN EN 13501-1 class E: single-flame source test

Special applications: hydrostatic pressure test

- Self-designed automated test setup to investigate the pressure and temperature stability of foam cores
- Characterization of foams used as sandwich cores in press processes
 - Testing of foam sandwich cores to measure material consistency at high temperatures and under pressure within a fluid
 - Precise data logging of temperature, pressure and volume flow
 - Deformation behavior of the foams can be filmed, observed and measured
 - Temperatures up to 150 °C and pressures up to 50 bar
 - Testing procedure is fully automated and is controllable by a tailored software
 - Various testing programs (constant pressure, pressure ramp etc.)
- Measurements with Rheotens device combined with capillary rheometer:
 - Measurement of extensional viscosity
 - Quality control
 - Estimation of foamability
- Melt flow index
 - MVR/MFR and melt density of thermoplastic polymers

Thermal and chemical analysis of foam raw material

- Differential scanning calorimetry (DSC)
 - Determination of melting point
 - Crystallization kinetics of thermoplastic materials
- Analytical TGA and TG-MS
 - Detection of volatile substances, impurities
- Determination of foaming agent content
 - Halogen moisture analyzer, Mettler Toledo
 - Macro-TGA, Leco
- Determination of molecular weight distribution by GPC (gel-permeation chromatography)
- Residual moisture measurement (calcium hydride method)

Rheological testing methods of foam raw material

- Measurements with high-pressure capillary viscometer:
 - Determination of shear viscosity and shear stress
 - pVT measurements-isothermic and isobaric
 - Temperature and pressure dependent thermal conductivity

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