

Foam extrusion – thermoplastic foams

Thermoplastic foams can easily be produced as semi-finished products using a continuous extrusion process. The broad and continually widening application spectrum for parts made of extrusion foams ranges from insulation materials in the construction sector through to packaging and lightweight components.

Properties of direct-foamed semi-finished products

- High specific strength
- Very good thermal insulation properties
- High energy absorption per unit weight
- Low component thicknesses
- Homogeneous cell distribution, including at higher component thickness

Material and process development

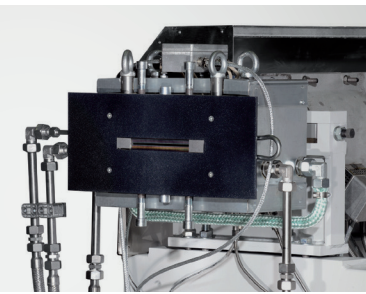
In complex polymer foaming processes, foamed plastics often require a tailored property profile to achieve optimum results. Fraunhofer ICT offers both the know-how and the comprehensive equipment needed for a targeted development. Flexible production technology (extruder and screw configuration) enables the further development of materials and processes in order to achieve the required results.



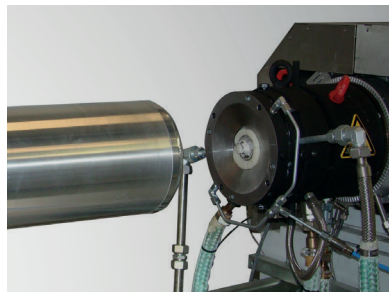
KraussMaffei Berstorff Schaumtandex ZE30/KE60

Processing technology

In the area of foam extrusion a wide range of equipment is available in Fraunhofer ICT's pilot plants. Beside the Berstorff Schaumtandex ZE30/KE60, the institute has a twin-screw extruder (Leistritz Micro 27-40D) with direct foam injection. A wide range of dosing units are also available for dosing materials and introducing various blowing agents.



Slot die for the production of semi-finished foam sheets



Annular gap nozzle for the production of foam foils

Schaumtandex ZE30/KE60

The KraussMaffei Berstorff Schaumtandex laboratory unit ZE30/KE60 is a flexible processing concept for the production of foamed semi-finished products using physical and/or chemical blowing agents. It comprises a twin-screw extruder as a primary extruder (plastification, additivation and gas loading of the polymers) and a secondary single-screw extruder for cooling and homogenizing the melt. With this technology, foamed foils (annular gap die), foamed profiles and foamed sheets (wide slot die or multi-hole die) can be produced using different tools.

Parameters:

- Throughput: 30 - 60 kg/h
- Temperature: up to 350 °C
- Geometries: Slot die for sheets (approx. 300 mm x 50 mm) with sheet calibrator

This pilot plant unit enables trials to be carried out on a pilot scale, and the knowledge obtained can be transferred into the production process. The unit also offers significant flexibility in determining the processing parameters for new material combinations.

Dosing of the blowing agents

Blowing agents are introduced using one of the two low-pressure dosing stations (e.g. ethanol, pentane and butane) or the high-pressure dosing station (e.g. nitrogen and carbon dioxide). Mixtures of up to 5 blowing agents can also be introduced simultaneously.

Twin-screw extruder with a direct foam nozzle

For material and foaming trials a co-rotating twin-screw extruder (Leistritz Micro 27–40D) with a melt pump and direct foam nozzle is available. This can be used to produce a foamed polymer strand to characterize the properties of the foam. By this means it is possible to determine the influencing variables (for example the effect of additives or processing parameters) on the foaming process. With a throughput of 3–30 kg/h the foamability of even small quantities of materials can be investigated. The process is therefore extremely well suited for screening trials.

Service portfolio

We offer numerous individual and market-oriented research services:

- Material modification (reactive, additives, blending) to improve the melt properties and the associated foamability of the materials
- Development and optimization of foam extrusion processes
- Investigation and variation of key parameters
- Processing of individual polymers and combinations:
 - Thermoplastic polymers such as polystyrene (PS), polypropylene (PP), polyethylene (PE)...
 - Biopolymers, e.g. cellulose acetobutyrate (CAB), cellulose propionate (CP) and polylactic acid (PLA)
- Investigation of different blowing agent combinations
- Pilot-scale trials to optimize the production process
- Characterization of foam samples in terms of their mechanical, thermal and morphological properties
- Development of new production concepts for material compounds
- Individual solutions with tailored properties

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