Fraunhofer ICT

Particle foams

Process chain from polymer to component – optimization of conventional foams – new energy-efficient processing methods for biobased and engineering polymers

The wide and steadily growing range of applications for particle foam components extends from insulation materials in the construction sector, and packaging, sports goods and transport containers, through to vehicle and plant construction. Customized material combinations and processing technologies are increasingly required to meet the high demands placed on the components.

Properties of expanded particle foams

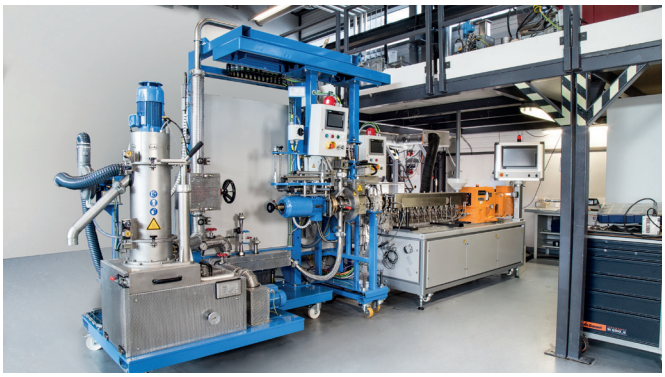
- Very good thermal insulation properties
- High energy absorption per unit weight
- Possibility to achieve low component densities < 20 kg/m³
- High design flexibility in terms of product geometry
  - 3D moldability of the components/components with near net shape
  - Possibility to produce a wide range of wall thicknesses, down to thin ribs
- Homogeneous cell distribution, including at higher wall thicknesses

Material and process development

With modern equipment and processing technologies for the development of particle foams, each step in the processing chain can be carried out at one location, from the production of beads with customized properties through to particle pretreatment and the production of a finished component. Fraunhofer ICT develops particle foams from various polymers via particle foam extrusion (Leistritz twin-screw extruder with Gala-UWG) or the autoclave process (0.1-15 l volume). Researchers are working to optimize and further develop production processes for molded parts in terms of energy consumption, product quality and surface and mold technology.

The development of new processing concepts for the production of compounds and hybrid structures continues to be a key activity within the research group for foam technologies.

Extrusion line with Kurtz Ersa Wave Foamer RF-C



Underwater pelletizer

Particle foam processing

In addition to equipment for pretreatment of the particles (pressure loading and pre-foaming), two highly flexible technologies are available for the production of particle foam components:

Laboratory-scale steam chest molding machine
This technology, which was developed at Fraunhofer ICT, enables the production of samples (200 x 200 x 50 mm³) with a precisely adjustable density, using even small quantities of material. This allows the investigation of the weldability and mechanical properties.

Freely-programmable steam chest molding machine Erlenbach GmbH
Using this modified industrial unit, pre-expanded particle foam beads can be sintered to form molded parts at vapor pressures of 7.5 bar. The freely-programmable process control enables the processing parameters to be adjusted to the material properties and the geometry of the molded part. Numerous molds are available for the steam chest molding machine, allowing, for example, the cavity to be filled from both sides.

Radio-frequency-based molding machine Kurtz Wave Foamer
This is a new technology that uses electromagnetic waves (radio frequency) instead of steam to process particle foams. This allows different temperature ranges to be achieved and new material combinations to be created. Using this method to process moisture-sensitive materials also offers significant advantages by avoiding water vapor.

Service portfolio

In the field of particle foam processing we offer a range of tailored and market-oriented research services:

- Modification of polymers to improve foamability as well as their specific properties (e.g. flame retardancy)
- Development of expandable or expanded beads by particle foam extrusion (twin-screw extruder with underwater pelletizing)
- Development of expanded beads using autoclave technology (up to 15 liter volume)
- Process development for the production of molded parts
- Processing of tailored polymer combinations:
  - Thermoplastic polymers, e.g. polypropylene (PP), polystyrene (PS), polyethylene (PE)
  - Biopolymers, e.g. cellulose acetobutyrate (CAB), cellulose propionate (CP) and polylactic acid (PLA)
- Multicomponent parts, e.g. expanded polypropylene (EPP) and aluminum particle foam
- Dosing technology for large particles (d = up to 8 mm)
- Investigation of weldability
- Energy-efficient production of molded parts, and measurement of energy consumption
- Integrated components / back-foaming of foils and textiles
- Integral skin technology
- Development of customer-specific mold technologies
- Tailored solutions

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