Conventional thermoplastic foams made from polystyrene or polyolefins are extensively applied, particularly in the packaging and building segment because of their light weight, their ability to absorb energy and their excellent insulation properties. However, some industrial applications have a requirement profile that exceeds the demands placed on standard materials. For example, thermoplastic foams are already used as a core material in rotor blades for wind power plants. In the future, they could be used in temperature-sensitive applications such as acoustic insulation in near-engine areas in the automotive segment or thermal insulation of thermally stressed climate tubes.

Both the temperature resistance and the mechanical properties of thermoplastic foams play an important role in opening up new fields of application.

The research focus of Fraunhofer ICT is the development of high-performance polymer foams from new material systems in the particle and the extrusion foaming process. New materials like technical polymers often cannot be processed by conventional methods, so the new development and the advancement of manufacturing processes and process technologies play a particularly significant role.

**High-performance polymer foams**

**Structural foams – temperature-resistant foams – particle and extrusion foams**

Current thermoplastic foams do not show a high temperature resistance. Expanded polystyrene (EPS) shows a long-term temperature resistance of 70°C to 85°C and a short-term temperature resistance up to 100°C. Expanded polypropylene shows a temperature resistance of 100°C to 110°C. Foams with higher temperature resistances like PET foams provide the opportunity...
to use composite materials made from new material combinations. Through the thermally modified properties of the polymer foams, high-temperature foams can be processed for example in compression molding processes for the production of sandwich materials, which need a high temperature and pressure resistance.

The advantages of foams with a high temperature resistance are:
- Dimensional stability under heat
- High short-term resistance
- Better mechanical properties at higher temperatures
- Potential application in new process technologies

**Structural foams**

Besides the use as a sandwich core material, structural foams can be applied in areas where high compressive strength, high energy absorption and bending strength with simultaneously low specific volumetric weight are required.

At Fraunhofer ICT the mechanical properties of foams are being optimized by the use and modification of technical polymers and additives as well as the specific optimization of processes and parameters. This enables the properties to be adjusted to specific applications.

The resulting advantages include:
- Good mechanical properties
  - Compressive strength
  - Bending strength
- Higher long-term resistances
- Very good specific property profiles

Possible application areas for high-performance foams:
- Lightweight construction
- Air conditioning
- Automotive
- Aviation
- Protective equipment

**Structural foams**

At Fraunhofer ICT, different processes for the development and manufacturing of high-performance foams are available. Several different dosing systems for the addition of high-melting polymers and additives are accessible. Extensive know-how and equipment for the manufacturing of foamed semi-finished products and components both in the particle foam and the extrusion process are available. For the particle foam process an extrusion line from the Leistritz Corporation with a subsequent underwater granulation (Gala) is used both for the manufacturing of foamed particles and gas-loaded granulate.

Further processing can be carried out using both a pre-expander and steam-chest molding machines in laboratory and industrial scale from Erlenbach GmbH. Furthermore semi-finished products like foamed boards and films can be produced continuously by the extrusion process using a KraussMaffei Berstorff-Schaumtandex laboratory scale unit ZE 30/KE 60.

**Service offer**

- Material and formulation development for manufacturing tailored foams
- Optimization of technical property profiles
- Process optimization for manufacturing of high-performance foams
- Characterization of matrix materials and foams
- Particle foams and extruded foams
- Individual solutions