Polymer Processing -
Tailoring material properties for innovative applications
Our brand "Polymer Engineering" stands for scientific and practical research and teaching in the field of polymer materials. The department of Polymer Engineering at the University of Bayreuth, the business area of plastics at the New Materials Bayreuth GmbH and the department of Polymer Engineering at the TuTech Innovation GmbH in Hamburg embody this brand under the guidance of Prof. Dr.-Ing. Altstädt. The main research at all three locations lies on material, construction and production, with the aim to develop high performance plastic products. The focus of the research is the systematic analysis and use of causal relationships between processing, structure and properties of polymer materials. This allows a strategic approach to the development of innovative products with the help of modern polymer materials.

With our equipment we are able to process polymeric materials from the lab scale (~10 g) to the technical scale (1 - 25 kg) and characterize the products.

Our mission is to support your research and development activities from the basic experiments to the prototype production with modern equipment and long-standing competence.
Our equipment for standard processes is specially designed to process all polymeric materials and additives in the range of several gram to several kilogramm and temperatures up to 400 °C.

Flexible screw design and side-feeder allow to produce innovative polymer compounds. Co-extrusion equipment and 2-K injection molding combined with injection compression molding enables to produce tailormade products with classical processing techniques.

top: compatibilized blend system with nano-structured interphase
bottom: Nanocomposite of polymeric matrix and exfoliated nanoclay.
Long-fibre reinforced thermoplastic materials

SPECIAL TECHNOLOGY

Advantages of IMC-technology

- Single step process
- Continuous processing
- Minimal deterioration of fillers and fibres
- Reduce product finishing
- Minimize material handling
- Combining compounding and injection molding

To investigate and establish innovative processing technologies is one of our main tasks at the Department of Polymer Engineering.

In cooperation with New Materials Bayreuth GmbH an IMC-injection molding compounder is available to incorporate various fibres in polymeric matrices. Lightweight designed parts of these materials with excellent mechanical properties allow to substitute conventional metallic materials especially for automotive applications like frontends and underbody structures.
Foaming of polymers

OUTSTANDING LIGHT WEIGHT PRODUCTS

Polymer foams are lightweight, low density products. The field of application for polymer foams ranges between sound and thermal insulation in building panels, impact absorption in vehicles, sports accessories and packaging.

The foaming equipment is designed to process all polymeric materials up to high temperature thermoplastic resins with a wide variation of blowing agents from inert gases to organic liquids as well as their combinations.

Our group is able to investigate the foaming behavior of polymers starting with the polymeric material properties relevant for foaming going on with the polymer-blowing agent interaction to the foaming process and the final foam properties as foam structure and mechanical properties.

![Discontinuous Batch-Foaming](image1)

**Discontinuous Batch-Foaming**
- Autoclave to foam polymeric materials using the temperature step or pressure step method

![Discontinuous Particle Foams](image2)

**Discontinuous Particle Foams**
- Welding of foamed particles after processing in a particle foam molding machine

![Semicontinuous Foam Injection Molding](image3)

**Semicontinuous Foam Injection Molding**
- Structural foam with defined surface quality and thickness and density reduction using gas counter pressure, variotherm and breathing mold technology

![Continuous Foam Extrusion](image4)

**Continuous Foam Extrusion**
- Foam extrusion process with physics of foaming for continuous production of polymeric foams
Characterization of products

FROM NANO- TO MACROSCOPIC
PRODUCT PROPERTIES

To optimize polymer processing the influence of the material properties and the processing steps on the product properties have to be analyzed. Therefore characterization methods from non-destructive, destructive, dynamic or static testing are developed at the Department of Polymer Engineering.

Equipment

- Light microscope
- Scanning electron microscope
- Transmission electron microscope
- µ-Computer tomograph
- Fiber length analysis system
- Differential scanning calorimeter
- Dynamical-mechanical analysis
- Thermo gravimetric analysis
- Universal testing machines
- Falling impact tester
- Servohydraulic pulsers

Dynamic Testing of Compact and Foamed Materials

µ-CT Characterization and Reconstruction