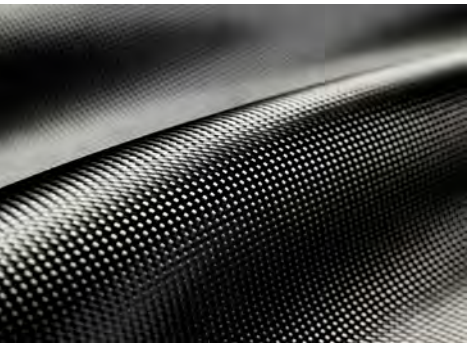


Thermosets and Composites

Tailoring material properties for innovative applications

ENGINEERING POLYMER

UNIVERSITÄT BAYREUTH

Tailoring of High-Performance Composites

KEY OF SUCCESS

Standard processes

- Resin Transfer Moulding
- Infusion
- Compression

Mixing Technology

- Speed Mixer
- High pressure homogenisator
- Vacuummixer

Curing/ Conditioning

- Convection oven
- Vacuum oven
- Conditioning cabinet

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 these brand under the guidance of Prof. Dr.-Ing. Altstädt. The main research at all three locations lies on the material, the construction and the 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.

Our group combines physical and chemical fundamental knowledge to bring innovative smart materials into real world applications.

A number of modern industry-relevant manufacturing methods are available. The characterization of the large spectrum of properties belongs to our daily work

By building a bridge between pure science and industrial needs, our group is proud to be a reliable collaborator on the development of the new generation of composite materials with our industrial partners.

Process Chain

CUSTOMIZED TECHNOLOGY

Our Resin Transfer Moulding (RTM) system is specifically designed from the beginning to fulfil the needs of wide range of possible current and future industrial applications while maintaining the ability to work in laboratory scale.

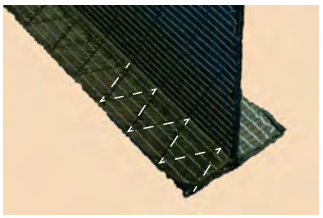
The possibility to inject both, one and two component systems makes it even more universal. In the latter case a wide range of mixing ratios is adjustable. Additionally the machine operates together with a 1100 kN press, operating with heating and cooling rates of 7 °C/min. The full set of various sensors installed on both machines allows us to monitor vital injection parameters.

To conquer the evolving demand for automation we developed a testing method to evaluate internal release agents.

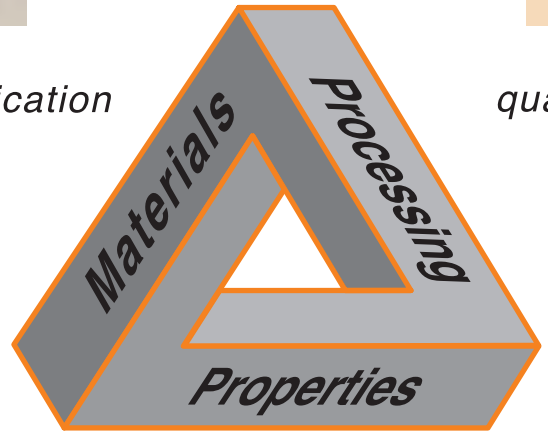
Internal Release Agent

quantitative classification method

Preforming



quality management



Tailored material performance

Fast Curing

fast heating and cooling rates

Injection

flexible process controlling

Research fields

DIVERSITY OF AREAS

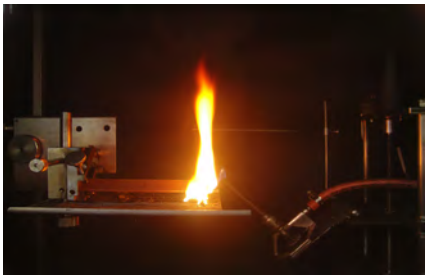
Establishing relationships between processing, structure and properties of modern polymer composites is the main aim of the group. For this purpose, sophisticated equipment allows processing of polymers from lab-scale to an industrial relevant scale.

Equipment

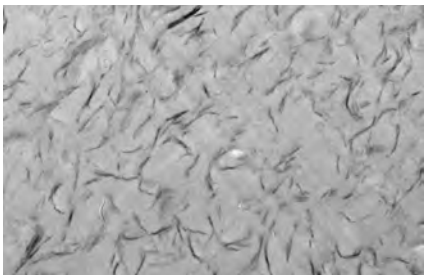
- Modulated differential scanning calorimeter
- Dynamical-mechanical analysis
- Micro thermal analysis
- FT-IR spectroscope

- Light microscope
- Ultra sonic scanner
- Universal surface tester
- Micro computer tomograph
- Scanning electron miroscope
- Transmisson electron microscope
- Atomic force microscope

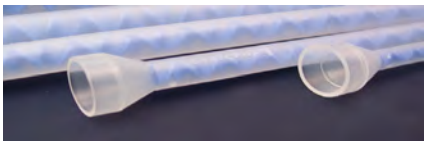
- Universal testing machines
- Falling impact tester
- Servo hydraulic testig machines



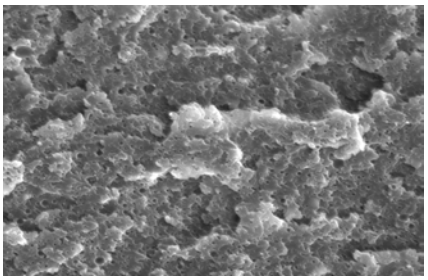
FLAME RETARDANCY



NANOCOMPOSITE

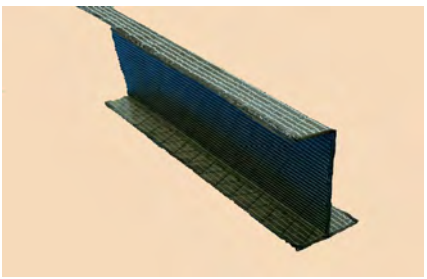


FAST CURING SYSTEMS



FRACTURE TOUGHNESS

FATIGUE

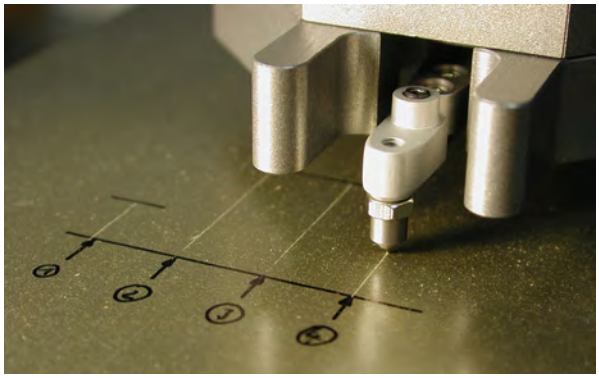


PREFORMING

Composite Surfaces

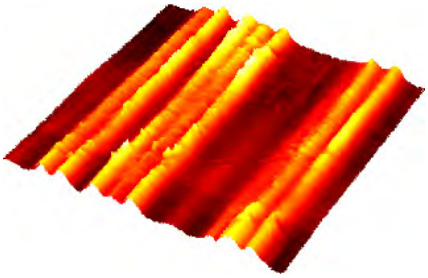
INTERPHASE

The knowledge about the surface structures of composite materials is essential for all parts which are coated, bonded or painted afterwards. To get good adhesion with this secondary layers surfaces are often treated in a way to increase the roughness. Not only the interaction with other materials is affected by the surface structure but also the optical quality of the final component. The investigation of surface structures helps to establish an understanding how material`s properties, processing parameters and post treatments affect the final surface.

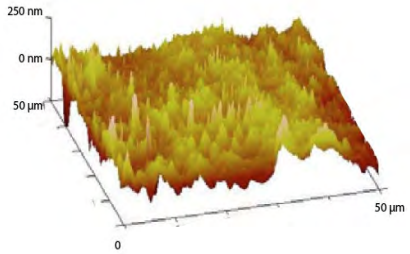


Methods

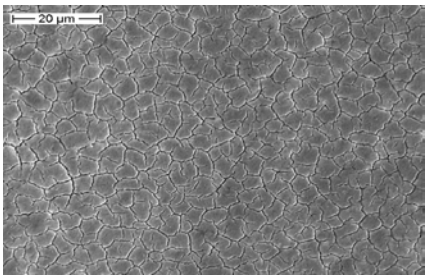
- Abraision
- Scratch Resistance
- Micro Friction
- Surface roughness
- Micro Tribology
- Haptics
- Micro Thermal Analysis
- Micro DSC



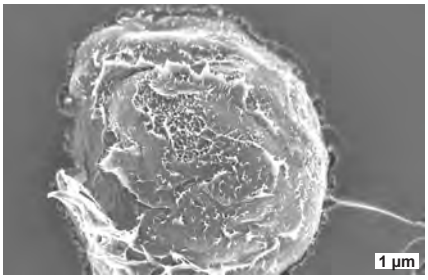
Micro Thermal Analysis



Atomic Force Microscope



Scanning Electron Microscope



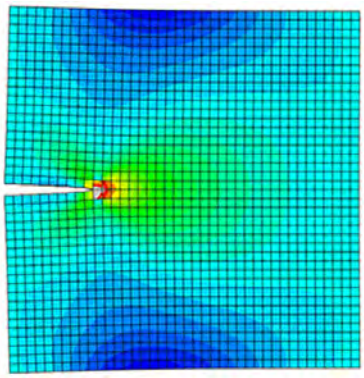
Field Emission Microscope

Mechanical Testing

ENVIRONMENTAL EFFECTS ON FATIGUE PROPERTIES

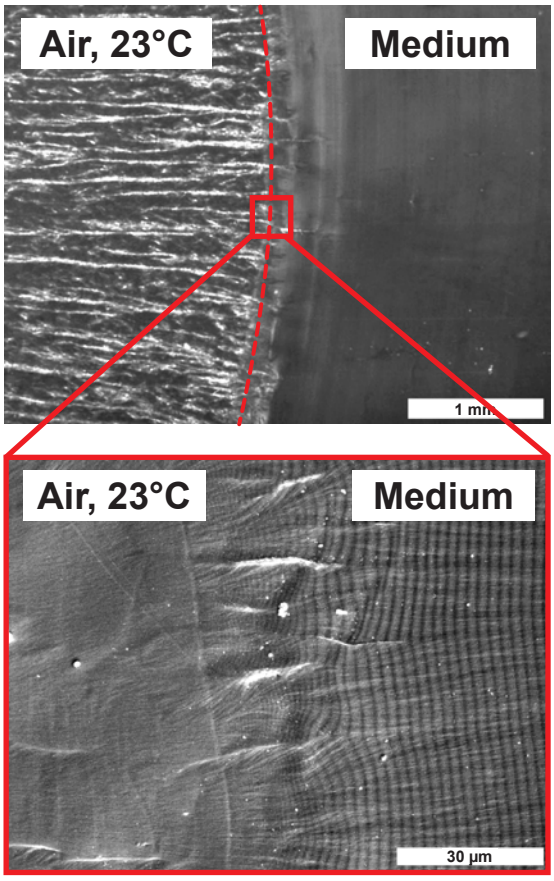
The use of structural adhesives and fibre-reinforced plastics as construction materials in more and more applications leads to increasing demands on the material properties.

In addition to static mechanical testing the material`s fatigue performance has to be investigated as well. This is essential to exploit the composites potential in terms of an optimized, application-oriented lightweight design.
Since most of the composite are used under different environmental conditions the effects of environmental impacts on the fatigue properties have to be investigated as well.



For this purpose Polymer Engineering developed an advanced servohydraulic test lab to investigate fatigue crack propagation in polymeric matrix materials both at different temperatures and under the influence of aggressive media. This allows reliable lab scale testing of materials under realistic operating conditions.

Testing temperatures go from -40 °C to 170 °C and can be combined in an appropriate range with different testing media, like salt water and oil but also volatile media such as gasoline or organic solvents.



Fatigue Crack Propagation Fracture Surfaces before and after the Addition of Aggressive Medium

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