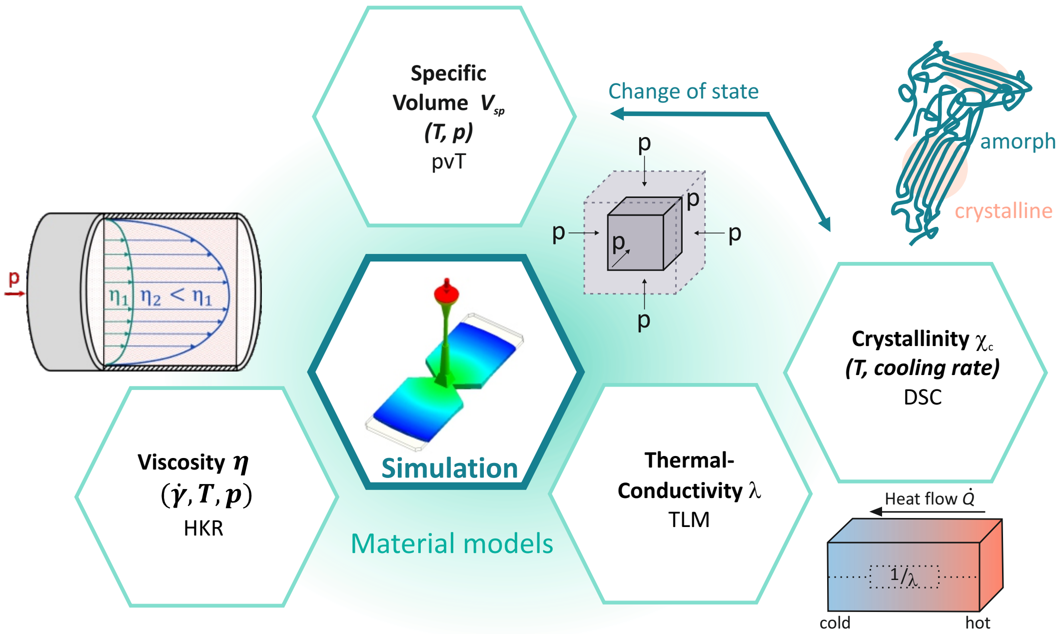
Leibniz-Institut für Polymerforschung Dresden

Characterization of processing behavior

In order to achieve the required performance characteristics of plastic parts with the least possible energy input the process, settings must be adapted to the material behavior. The empirical approach to determine an appropriate processing window requires high amounts of material and energy and does not guarantee an optimal result. A solution to this problem is the characterization of material behavior on a laboratory scale. Data is generated with less effort, which in turn can be used to evaluate and/or visualize the process using simulation.

Physical depiction of processing behavior

Meaningful material parameters are indispensable for the simulation of polymer processes. Therefore, correlating data from material characterization with processing behavior forms a big part of the research work at the IPF. Methods to characterize processing behavior include, amongst others, high-pressure capillary rheometry (HPCR), differential scanning calorimetry (DSC) and measurements of pressure-volume-temperature relationships (pvT) and thermal conductivity (TCM).

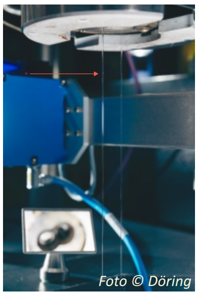


Measuring equipment

High-pressure capillary rheometry (HPCR) is a suitable tool for the characterization of material specific flow behavior under process-like conditions. At the IPF it is additionally possible to correlate the material specific flow behavior with the process history through a plastification unit that is directly coupled with the HPCR. A counter-pressure chamber is also available to analyse the pressure dependant flow. Furthermore, by using laser techniques and special die geometries to detect and quantify pressure fluctuations within the die, a comprehensive analysis of die-swell and flow instabilities is possible.

Measurement with a directly coupled plastification unit

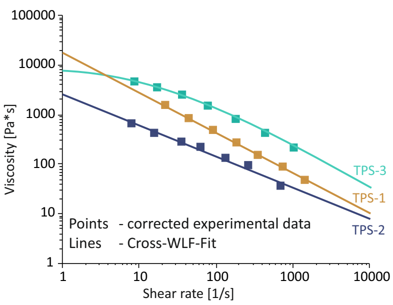
Counter-pressure chamber measurement



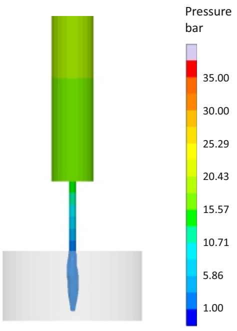
Die swell measurement

Quantitative determination of the sharkskin effect

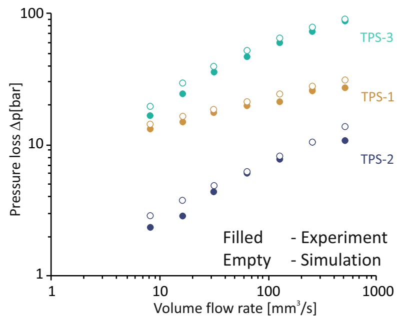
Viscosity data estimation and evaluation



Viscosity curves of Thermoplastic Elastomers based on styrene-

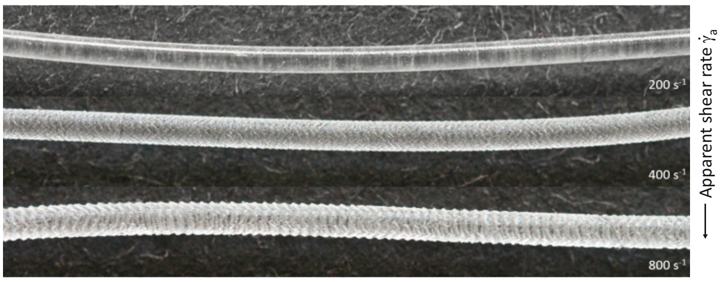


Simulated volume flow through the HPCR

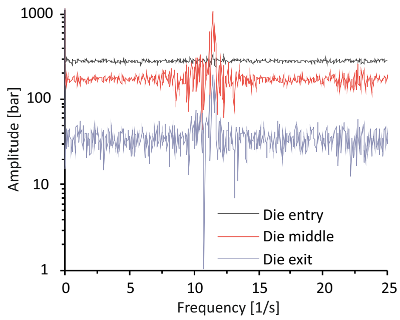


Simulated volume flow through the HPCR

Flow instability analysis



Flow instabilities of extrudated strands of a analysis styrene-copolymer (qualitative)



Quantitative analysis of flow instabilities (HDPE)

Contact

Leibniz-Institut für Polymerforschung Dresden e. V.
Department Processing Technology
Dr.-Ing. Ines Kühnert
E-Mail: kuehnert@ipfdd.de
T +49 (0)351 4658 368
F +49 (0)351 4658 290

Hohe Straße 6 . 01069 Dresden . Germany
www.ipfdd.de

Literature

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