Friedrich-Alexander-Universität
Technische Fakultät

The **Institute of Advanced Optical Technologies – Thermophysical Properties (AOT-TP)** offers a

Position as Research Assistant (m/f/d) with the perspective of a doctorate

for a research project with the tentative title

Influence of solubility, viscosity, and diffusion coefficient in blowing-agent-loaded plastic melts on the structure of polymer foams

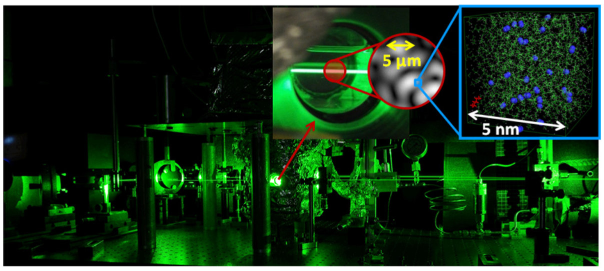
Plastic foams offer various advantages as, e.g., their excellent thermal or sound insulation properties. In a physical foam extrusion process, the blowing agent is injected into the plastic melt under high pressure. After homogenization, the blowing-agent-loaded plastic melt is ejected through the extrusion die, where pressure and temperature drop from about 30 MPa to 0.1 MPa and from about 523 K to 293 K. Due to the pressure drop, nucleation of gas bubbles is induced. Transport of the blowing agent from the solution into the gas nuclei leads to bubble growth, where the kinetics of the bubble growth are decisive for the foam morphology and, thus, for the resulting foam properties. Up to now, there is a lack of reliable literature data for the solubility, the binary diffusion coefficient, and the viscosity for the thermodynamic states relevant in the foaming process. Thus, reliable modeling is possible neither for the sub-process of bubble growth nor for the prediction of the foam structure.

The aim of a new DFG-funded research project performed in cooperation with the Institute of Plastics Technology at the University of Stuttgart is to better understand the influence of the solubility, diffusion coefficients, and viscosity of the homogeneous blowing-agent-loaded plastic melt on the formation process of plastic foams. In the future, this should allow to predict the properties of such foams on the basis of the measurable and controllable properties of state in form of temperature, pressure, and mixture composition. As a basis for the development of corresponding models, the above-mentioned properties of blowing-agent-loaded plastic melts are first to be determined in a systematic parameter study. For this, selected polymers, blowing agents, and process variables will be investigated. By this, the influences of the molecular properties including molecule size, weight, and structure as well as of molecular interactions occurring in the mixture on the sub-processes of the extrusion process and on the foam properties will be studied. The determined properties should then be correlated with each other to obtain an improved understanding of the underlying mechanisms as well as the interdependencies. The corresponding foaming experiments and viscosity measurements will be carried out at the cooperation institute of the University of Stuttgart. By analysis of the bubble growth as well as the characterization of the resulting foam structures or morphologies at varying experimental boundary conditions, correlations between the properties of the blowing-agent-loaded melts and the resulting foams should be revealed.

The investigations to be performed at AOT-TP make use of basically existing simulative and experimental methodologies. These have to be further developed and implemented considering the requirements of the project, where support of experienced colleagues will be given. In addition to dynamic light scattering for the contactless, accurate determination of diffusion coefficients in mixtures consisting of the polymer melt and a dissolved blowing agent, Raman spectroscopy and the isochoric saturation method are used to determine the solubility of the blowing agent in the melt. In connection with the experimental investigations, a major challenge is the methodological development to access the thermodynamic states of interest as well as to deal with the technical character of the samples. For the establishment of structure-property relationships, the experimentally investigated states are also studied by means of molecular dynamics (MD) simulations, which provide insight into the fluid structure and allow the theoretical calculation of thermophysical properties.

For the research project, we are looking for a graduated researcher with strong interests in the fields of optics and thermophysical property research as well as experimental and simulation techniques. Prior knowledge about the programming language LabVIEW as well as experience in the fields of optical metrology, control technology, and electronic engineering are welcome, but not a prerequisite. We offer a multidisciplinary, team-oriented, and international working environment with excellent potential for scientific and personal development.

The position is to be occupied as soon as possible. It is limited to 3 years with the possibility of extension. With appropriate qualifications and suitability, the payment is based on pay group 13 according to TV-L.



If you are interested in working with us, please send your application documents to

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