Friedrich-Alexander-Universität
Technische Fakultät

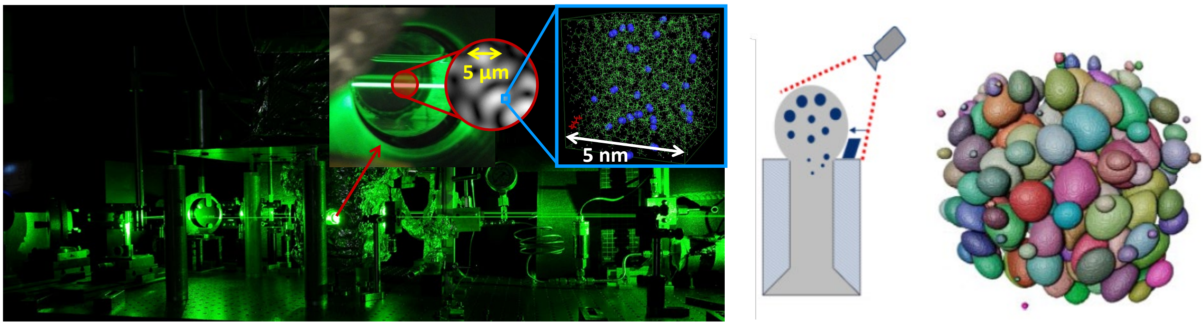
The **Institute of Advanced Optical Technologies – Thermophysical Properties (AOT-TP)** offers a

Master Thesis

with the tentative title

Determination of Diffusion Coefficients in Blowing-Agent-Loaded Polymer Melts by Dynamic Light Scattering

Plastic foams offer various advantages by, e.g., their excellent thermal and acoustic insulation properties. In a foam extrusion process, the kinetics of the bubble growth are decisive for the foam morphology and, thus, for the resulting foam properties. For tailoring the latter, knowledge about transport properties such as the Fick diffusion coefficient D_{11}, which describes the transport of the blowing agent from the solution into the gas nuclei leading to the bubble growth, is necessary. Up to now, there is a lack of D_{11} data for the thermodynamic states relevant in foaming processes. Thus, reliable modeling is not possible for the sub-process of bubble growth and the prediction of the foam structure.
Dynamic light scattering (DLS) is an optical technique that allows the accurate determination of D_{11} and the thermal diffusivity a in an absolute way without calibration by the analysis of microscopic fluctuations originating from the random movement of molecules in macroscopic thermodynamic equilibrium.



The main task of the master thesis is to contribute to a fundamental understanding of how mass diffusion is affected by the characteristics of selected polymers and blowing agents at process-relevant conditions covering a wide range of temperatures, pressures, and compositions. In a first step, an existing DLS setup has to be further developed in combination with additional measurement techniques. Raman spectroscopy should be applied simultaneously for the determination of the blowing-agent concentration as well as the identification of structural changes in the plastic melt. The experimental results for D_{11} should be correlated as a function of temperature and blowing-agent concentration and, thus, contribute to the development of a predictive model for the bubble growth in plastic melts.

We are searching for a committed student with interests in optical metrology and thermophysical property research. We offer a diverse, multidisciplinary, and international working environment with excellent potential for scientific and personal development. The thesis can be carried out in English or German.

Start of the thesis: July 3rd, 2023

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