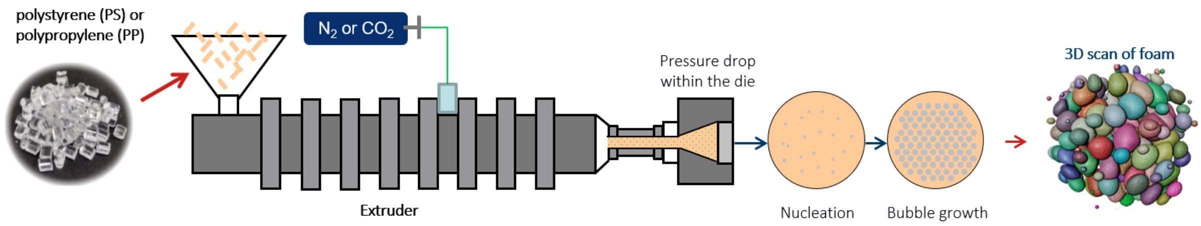
The **Institute of Advanced Optical Technologies – Thermophysical Properties (AOT-TP)** offers a

Master Thesis

with the tentative title

Solubility of Blowing Agents in Polymer Melts

Background Information: Polymeric foams are employed in different applications, including packaging, insulation, construction, automotive and aerospace components, sports equipment, medical devices, and more. Such foams can be produced by injection molding or extrusion using chemical or physical blowing agents. For the latter, carbon dioxide CO_2 or nitrogen N_2 are commonly used. The blowing agent is injected into the polymer melt at a defined mass fraction and the mixture is homogenized by an extruder screw. After extrusion to lower pressure levels, the blowing agent desorbs from the supersaturated polymer melt and nucleation as well as bubble growth take place. Both of these mechanisms highly influence the final foam structure and, thus, its properties and are mainly governed by the thermophysical properties of the used polymer and blowing-agent mixture.



Here, accurate design and optimization of the foam matrix microstructure require a reliable predictive model. For the development of such models, however, comprehensive data on thermophysical properties, such as solubility, volume swelling, and mass diffusion are crucial. Unfortunately, reliable experimental data at the high pressures and temperatures characteristic of industrial foaming processes are scarce in the literature.

Tasks: This thesis aims to expand and improve the data situation on gas solubility and volume swelling for the blowing agents nitrogen (N_2), carbon dioxide (CO_2), or R134a in polystyrene (PS), linear and long-chain-branched polypropylene (PP) melts, exploring how these properties are influenced by the physico-chemical characteristics as well as different temperatures and pressures. For the determination of the gas solubility, the isochoric-saturation method combined with volume swelling data derived from pendant or sessile polymer droplets via axisymmetric drop shape analysis is employed.

The work will include experimental investigations of the gas-polymer mixtures under process-relevant conditions. In addition, the candidate will contribute to the design and optimization of the experimental setup needed for these investigations. Here, the candidate will also support further development of the methodology and evaluation strategy.

Demands and Benefits: We seek a motivated student with a strong interest in optical metrology, thermophysical property research and polymer science. Problem-solving skills and a willingness to learn are essential. We offer a dynamic, multidisciplinary, and international research environment with excellent opportunities for scientific and personal growth. The project provides hands-on experience with advanced experimental methods and the chance to contribute to cutting-edge polymer science research, fostering skills for future academic or industrial careers.

Start of the thesis: as soon as possible

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