Friedrich-Alexander-Universität
Technische Fakultät

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

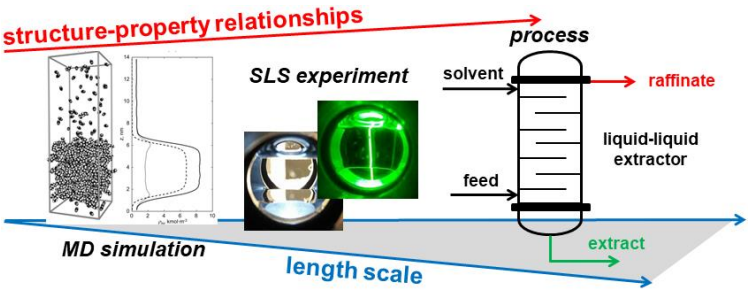
Position as Doctoral Researcher (m/f/d)

for a research project with the tentative title

Moderating effects of alcohols on the interfacial tensions in multi-phase systems consisting of carbon dioxide and organic solvents

Multiphase systems consist of at least two partially miscible phases which are separated by phase boundaries. Besides a vapor-liquid interface, also liquid-liquid interfaces can be present, sometimes even at the same time. A key property characterizing each interface is the interfacial tension. It is important in mixtures of carbon dioxide (CO_2) with organic solvents at high pressures, where liquid-liquid systems can be formed. Understanding the physics at the interfaces of multiphase systems is of importance in process engineering. In liquid-liquid extraction processes, for example, a solvent such as supercritical CO_2 is often used to extract the valuable solute product from the feed stream. Here, alcohols are attractive moderating agents for reducing the interfacial tension between the oil-rich and CO_2-rich phases and the minimum pressure to obtain full miscibility. For process and product design in connection with multiphase systems, knowledge on their interfacial tensions is necessary yet often lacking. This situation seems to be caused by the challenges adherent to corresponding experimental and theoretical methods.

The main objective of this project is to contribute to a fundamental understanding of the moderating effects of alcohols on the interfacial tensions in multiphase systems containing CO_2 and different classes of organic solvents. To characterize the phase boundaries, reliable information about their interfacial tensions should be obtained at conditions in the vicinity of the critical point of CO_2, where two- or three-phase systems can be found. For this, both experimental and theoretical work will be necessary. For an accurate measurement of interfacial tensions over a broad range down to vanishing values, the surface light scattering (SLS) method characterized by its contactless working principle at thermodynamic equilibrium has to be further developed with respect to its application for multiphase systems for pressures up to 20 MPa. The experimental interfacial tensions serve also to test molecular dynamics (MD) simulations in predictions for dense two-phase fluids. Furthermore, the latter should also be used for the interpretation of the measurement results on a molecular level. The findings from the experiments and simulations should allow for the development of a prediction model representing the influence of alcohols on the IFTs in mixtures with CO_2 and organic solvents.



For the research project, we are looking for a graduated researcher with interests in the fields of optics and thermophysical property research as well as experimental and simulation techniques. We offer a multidisciplinary and international working environment with excellent potential for scientific and personal development.

Project start: July 2022

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