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

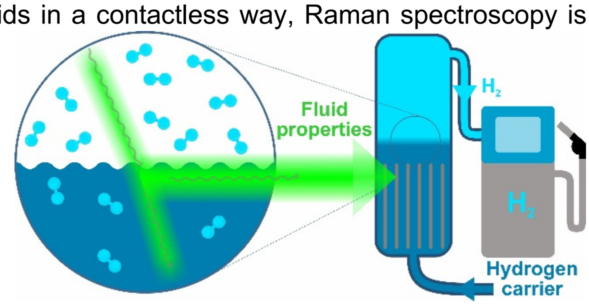
Position as Doctoral Researcher (m/f/d)

associated with the research topic

Characterization of Working Fluids Relevant for Hydrogen Storage and Transport by Optical Metrology

For a carbon-neutral or even carbon-free energy economy, green hydrogen (H_2) produced from renewable energy sources such as solar or wind energy plays an essential role. However, towards a mainly H_2-based energy economy, efficient and safe ways for its storage and transport are required. Several promising approaches for H_2 handling in large scale as well as in mobile applications have gained interest in the recent years. Those include the geological storage of gaseous H_2 in caverns or its chemical storage in the form of, for instance, methanol or ammonia, but also in liquid organic hydrogen carriers (LOHCs). Besides its role as energy carrier, H_2 also serves as chemical feedstock for the production of key bulk chemicals including, e.g., hydrocarbons, ammonia, formic acid, and methanol. In many of the aforementioned technologies, H_2 is in contact with liquids close to vapor-liquid equilibrium. For the proper design and optimization of the related processes and apparatuses, detailed knowledge on the thermophysical properties of the corresponding working fluids and their mixtures with H_2 as a function of temperature, pressure, and composition is required. The properties of interest include the transport properties dynamic or kinematic viscosity, thermal diffusivity or thermal conductivity, and diffusion coefficients, in particular Fick diffusion coefficients, as well as the equilibrium properties H_2 solubility, interfacial tension, and density. However, for many working fluids relevant for H_2 storage and transport, so far only limited knowledge on these properties especially in the presence of H_2 is given.

Current research activities at AOT-TP aim to establish a reliable database for such systems and properties at process-relevant conditions and to develop corresponding models useful for their application in process engineering. Within thermophysical property research, AOT-TP applies several optical and conventional measurement techniques on self-built experimental setups which can be operated with and without H_2 over a broad range of temperatures and pressures. With the help of dynamic light scattering (DLS) from the bulk of fluids, thermal and mass diffusivities can be studied simultaneously. By the application of DLS to liquid surfaces or interfaces, also called surface light scattering (SLS), the viscosity and interfacial tension are typically accessible at the same time. To measure the fluid phase compositions including H_2 concentrations in the studied liquids in a contactless way, Raman spectroscopy is used. Additionally, conventional methods such as, e.g., the pendant-drop technique for the interfacial tension and a solubility apparatus based on the isochoric-saturation method providing also H_2-saturated liquid densities are employed. At AOT-TP, a fundamental understanding on the influence of H_2 on the mentioned fluid properties can also be obtained by molecular dynamics simulations.



We are looking for a graduated researcher with interests and competences in the fields of optics and thermophysical property research to support our current research activities for working fluids relevant for H_2 technologies. We offer an interdisciplinary and international working environment allowing for an excellent scientific and personal development.

Start: as soon as possible

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