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

Diffusion of anisotropic particles in nanodispersions by dynamic light scattering

Dynamic light scattering (DLS) is an optical method which gives access to translational and rotational diffusion coefficients of particles in nanodispersions. In a current DFG-funded research project, DLS is further developed and used to study diffusion of nanoparticles in free media and under confinement, e.g., in porous materials. For the preparation of a second funding phase of the project, preliminary studies evaluating the potential of DLS with respect to the diffusion of anisotropic particles in nanodispersions should be performed, focusing on the following two aspects.

By coating nanoparticles with patches of another material, so-called patchy particles with properties being different from those of the underlying base particles can be produced. In the production of patchy particles, the degree of surface coverage achieved by the corresponding process is of high interest. This information would be very helpful while the particles are still in the coating dispersion. Although partially coated spherical particles remain almost spherical and the translational diffusion coefficient accessible by conventional DLS will hardly be affected, it can be expected that their surface heterogeneity induces further modes in the spectrum of scattered light related to the rotation of the particles. While the rotation of homogenous spherical particles cannot be detected by DLS, it seems to be plausible that the rotation of particles covered with patches of coating material will make this movement accessible by analysis of the anisotropic contribution to the scattered light. To probe this assumption and to find first ideas how corresponding signals can be related to the surface coverage of patchy particles, model systems for which the actual degree of surface coverage can be reliably tuned should be studied.

In another sense of anisotropic particles, it is well known that DLS can give access to translational and rotational diffusion coefficients of cylindrical particles such as nanorods. Their aspect ratio (length related to diameter) is an influencing factor for their rotation in form of tumbling and spinning around their principal symmetry axis, which is described by an orientation-averaged rotational diffusion coefficient. For less symmetrical particles such as triangular or rectangular plates, cubes, or pyramids, additional degrees of freedom in rotational movement might induce further modes in the isotropic and anisotropic parts of the scattered light. The identification and analysis of such information might be helpful for the characterization of the diffusion behavior and, thus, the morphology of synthesized particles. For such particles, it should be checked in DLS experiments with different polarization arrangements if additional light scattering signals for diffusion modes can be resolved in the experimental correlation functions and how they can be related to the underlying particle morphology.

For this project, we are looking for a graduated researcher with strong interests in the fields of optics and thermophysical property research. We offer a multidisciplinary and international working environment with excellent potential for scientific and personal development. The position currently limited to a period of 6 months provides the perspective of a doctorate within a continuation of the started work in the expected follow-up of the present DFG-funded project.

Project start: as soon as possible

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