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OPTICAL PROCESS ANALYSIS FOR THE CHARACTERIZATION OF NANOPARTICLES

Task

In the EU project PAT4Nano, Fraunhofer ILT is cooperating with nine European partners from research and industry to develop new tools for the real-time characterization of nanosuspensions. The project is focused on applications in the fields of pharmaceuticals, dyes and fine chemicals. Based on user requirements, the group is developing metrological processes for determining the size distribution of nanoparticles and their chemical composition as well as testing them in an industrial environment.

Method

Fraunhofer ILT is using the dynamic light scattering (DLS) method to determine the size of nanoparticles from their diffusional motion. To ensure that the method can also be used in a process, the institute has equipped the optical probe with a special »inline probe head«. The DLS method is based on the temporally resolved detection of single scattered photons from a small measurement volume in the nano- to picoliter range. So that the method can be used in suspensions with high particle concentrations, photons that have been scattered many times must be suppressed since they overlay the measurement signal. This is done by cross-correlating signals from two similar light scattering events at the same position in the sample. To this end, Fraunhofer ILT is developing a compact optical system and incorporating it into an immersion probe that can be used to characterize nanosuspensions in ongoing chemical processes without having to take samples.

Results

The inline DLS probe, which has been patented by Fraunhofer ILT, was further developed to improve its flow behavior. As a result, successive measurements can be performed with even further reduced cross-contamination. The probe's optics for the cross-correlation DLS method were developed, manufactured and integrated into an immersion probe, whose focus can now be adjusted precisely.

Applications

Nanoparticles play an important role in chemical, pharmaceutical and biotechnological processes. In the PAT4Nano project, the focus is primarily on dispersion processes. Fields of application include the grinding of crystalline pharmacological active ingredients, the production of inks from color pigments, and the production of nanoparticulate fine chemicals for catalysts or batteries, for example.

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3 *Optics simulation for the cross-correlation DLS probe with two excitation and two detection channels.*

4 *Cross-correlation DLS probe.*