Measurement of the aspect ratio distribution of rigid arbitrary shaped nanoparticles using the Translational–Rotational Image-based Dynamic Light Scattering

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The Dynamic Light Scattering method (DLS) is a method which permits to measure the Stokes radius distribution of a sample of polydisperse arbitrary shaped nanoparticles in Brownian motion, where the Stokes radius of a particle is the radius of the spherical particle which have the same translational Brownian motion [1]. In a conventional DLS experiment, the sample is illuminated by an incident focused laser beam and scatters the light toward a photomultiplier tube. The analysis of the light fluctuations recorded by the photomultiplier tube permits to obtain the distribution of their translational diffusion coefficients. Then, the Stokes radius distribution is measured.

The DLS has been improved in the Ultrafast Image-based Dynamic Light Scattering method (UIDLS) where the fluctuation of the light scattered by the sample is recorded by an image sensor instead of a photomultiplier tube [2,3]. Although the Stokes radius is related with the size, the conventional DLS or by the UIDLS don't permit to obtain information about the shape of the nanoparticles. This is the reason why we have developed an improvement of the UIDLS, named Translational–Rotational Image-based Dynamic Light Scattering where the light scattered by the sample is recorded by two cameras for two polarization geometries. From the light fluctuations recorded by the cameras, the translational diffusion coefficient distribution and the rotational diffusion coefficient distribution are measured. They are related with the translational and rotational Brownian motion of the nanoparticles and they permit to obtain the aspect ratio distribution of the arbitrary shaped nanoparticle complimentarily with the Stokes radius distribution which is also measured. This talk will be focused on the experimental measurement of the aspect ratio distribution of a sample of 2D nanoparticles, where the aspect ratio a 2D nanoparticle is defined as the aspect ratio of the disk-like particle which have the same translational and rotational Brownian motion.

References

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