Particle Shape Characterization with Light Scattering

Webinar Q&A Transcript

1 Since one can resolve the form factor only for objects of size comparable to the wavelength, then would it be possible to analyze particles with a one micron diameter?

Absolutely! In fact, the experiment presented in the webinar was realized on such spheres, for which the q-range considered is ideal to properly resolve the form factor.

We note that the system needs to be colloidally stable on the time scale of the measurement, hence one needs to watch out for issues like sedimentation.

2 Is it possible to include the polarisation to a usual DLS device or should one use a special device?

Yes, polarizers can in principle be added to any DLS device. In order to perform reliable particle shape characterization as described during the webinar, several elements are important to consider

- **Angular resolution**: one needs to obtain a depolarized DLS signal at different angles that depend on the properties of the system. Hence, a true multi-angle solution – 5 angles minimum - is needed for this application.

- **Laser**: depolarized DLS signals are typically much weaker than those acquired through polarized DLS. A high-power laser may thus be necessary to measure a sufficient signal.

- **Polarizers**: the more sensitive the polarizers are, the more it is important to have good rotational control when aligning both the entrance and detection polarizers.

LS Instruments offers a depolarized DLS option as well as a high-power laser selection with the LS Spectrometer. For more information, please contact us at sales@lsinstruments.ch.

3 Are there any issues to watch out for when conducting Depolarized DLS experiments?

As in the question above, in the depolarized DLS (or “VH” geometry), we typically deal with lower intensity than in polarized DLS. Systems with low contrast may yield very weak scattering intensities. As a result, the ICF may become noisy, and mandate longer measurements to ensure a reliable data analysis.

Nanorods produce a fantastic depolarized DLS signal and are extremely straightforward to characterize with depolarized DLS.

4 What criteria are in place (if any) to know if depolarized DLS can be used with certain particles? For e.g. - do we measure how the particles polarize light and is there a threshold?

There are no criteria: if one can detect depolarized scattering, one can benefit from it. Depolarized scattering is generally not more than 10% in intensity compared to polarized scattering. In other words, the so-called depolarization ratio I_{VH}/I_{VV} is usually below 0.1 for round (quasi-spherical) particles. For rods, fibers, etc. this number may be much higher.

Therefore, and as mentioned in question 1, depending on the particle system of your interest, one might require a more powerful laser than usual, but nowadays this is not a problem. In case of specific need, please contact sales@lsinstruments.ch.

5 For dilute polydisperse system, would the Radius of Gyration be a weighted average of the sum?"

Yes. One has to keep in mind that light scattering measures an intensity, which scales as $I \sim R^6$. Without any additional data from complementary techniques, one will always obtain weighted average values. The precise definitions of the weights acting in the average Radius of Gyration can be read at slide 23 in this presentation. Systems with a high polydispersity must be analyzed with extra care.

6 Can Depolarized DLS be used to characterize aggregates in a suspension?

Aggregates are heterogeneous, cluster-like particles and promote depolarized DLS extremely well. It is thus an excellent technique to detect aggregation in a suspension. Furthermore, depolarized DLS is more sensitive to size changes and one can thus achieve a better time resolution as compared to DLS when characterizing the kinetics of aggregation.

7 Is it possible to make depolarized light scattering experiments combined with the Modulated 3D technology?

Yes. For more details, please contact sales@lsinstruments.ch.