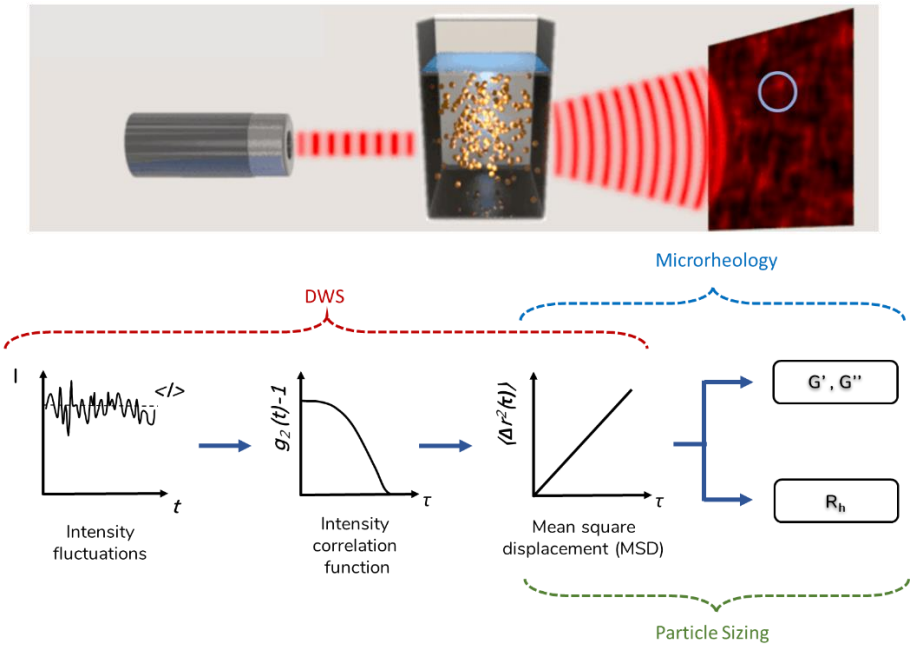
DWS-based Microrheology: Fundamentals & Applications

Webinar Q&A Transcript

1 Can you briefly summarize the principle of DWS Microrheology?

The DWS RheoLab measures the Brownian motion of particles in the sample and then computes the Mean-Squared Displacement. From there, one can already obtain information on the viscoelasticity and presence of a microstructure in the sample. Then, DWS Microrheology analysis can be performed to obtain the storage and loss moduli versus the frequency, as obtained via a mechanical rheometer. One can also perform particle sizing in purely viscous samples.

More detailed information can be found under the technology section on our website.



2 In the MSD curve displayed, there were two slopes: one was said to correspond to the solvent viscosity, the other to the solution viscosity. Is the latter the zero shear viscosity?

The first slope, at very short times, corresponds to the solvent viscosity and the second increase, at longer times corresponds to the solution macroscopic viscosity related to the terminal relaxation time, so it is indeed the zero-shear viscosity.

3 What is the difference between DWS and DLS Microrheology?

In DWS, photons are scattered multiples times whereas in DLS they are scattered only once. This means that in DLS only low concentrated and transparent samples can be investigated whereas in DWS highly concentrated and turbid samples are measured. As a consequence, the sensitivity and frequency range accessible through DWS is much higher than with DLS.

4 Do I need to add tracer particles?

Tracer particles can either be naturally present in a sample (e.g. droplets in an emulsion, particles in a suspension) or are added during the sample preparation for samples that are transparent or only slightly turbid.

5 What is the most common material for tracer particles?

We recommend TiO2 and Polystyrene colloidal particles, available from LS Instruments. Please contact sales@instruments.ch for more information. Sizes are around 0.3-0.5 micrometer. Other commercially available particles are suitable as well, for example Melamine. The requirements are that the refractive index is larger compared to the sample (at least 0.1 larger) and the size should be between 0.2-2 micrometer.

6 What is the volume fraction of tracer particles? Can we be sure that adding that many particles to the system doesn't change the properties?

Typical tracer particle concentrations given in wt.% are between 0.1 and 2 wt.%, depending on the sample and the path length of the cuvette used (between 1 and 10 mm).

Concerning the effect of adding tracer particles into the system, it is true that it is necessary to ensure that the tracer particles do not agglomerate and also that they do not interact with the system.