

DWS RheoLab: Specifications

The **DWS RheoLab** is a compact stand-alone instrument that allows optical rheology based on Diffusing Wave Spectroscopy (DWS) in a wide range of systems such as gels, dispersions, slurries, emulsions, foams and liquid crystals.

Application is possible to all homogenous transparent and opaque substances. It is particularly suited for white samples, because they do not require any sample preparation. In case of transparent systems you simply need to mix the sample with a small amount of tracer particles.

So far DWS has been predominantly applied in academic research in few specialized laboratories. With the **DWS RheoLab** by LS Instruments however, you no longer need to be an expert in the field of light scattering: the user friendly software solution provides automatic microrheology measurement and analysis for a huge range of soft materials.

The DWS RheoLab measures the Mean Square Displacement $\langle r^2(\tau) \rangle$ as well as $G'(\omega)$ and $G''(\omega)$ in 1 to 5 minutes with excellent reproducibility.

Storage $G'(\omega)$ and loss moduli $G''(\omega)$ can be measured from 1 Pa to 50 kPa in an unmatched frequency range from 0.1 to 10^6 rad/s* and on a wide range of viscosities extending from 0.1 mPa·s to 1000 Pa·s. With the pseudo cross-correlation upgrade the frequency range can be even further extended to 0.1- 10^7 rad/s*.

Furthermore the patented "Two-Cell Echo Technology" (EU Patent 1720000) cuts measurement times to only a few minutes even for slowly relaxing and solid-like materials.

DWS Microrheology

Diffusing Wave Spectroscopy (DWS) probes the dynamics in a sample on a nanometer-scale using laser light (not to be confused with the related, but less sensitive DLS microrheology). It measures the temporal fluctuations of light that is multiple scattered from particles embedded in the sample undergoing Brownian motion. The statistical analysis of these fluctuations allows the extraction of the microrheological properties of the sample. For homogenous samples these are in agreement with bulk rheology. It is thus a fast, contact free technique to measure rheological properties.



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*Accessible frequencies are sample dependent. Maximal values listed are based on the shortest accessible relaxation time scales.

Specifications: Version 3.4

- Full DWS microrheology solution in transmission mode (backscattering mode optional).
- The instrument is a stand alone device that can be set up in any laboratory environment. An additional optical table is not required.
- Powerful software solution for data acquisition and analysis: combined single-multi-speckle measurement, user defined multi-run scripts, online microrheology analysis and full data access. Comprehensive data representation: MSD, Creep Compliance, $G'(\omega)$, $G''(\omega)$, $G^*(\omega)$, $\eta^*(\omega)$, and loss tangent.
- Fully automated determination of transport mean free path l^* and absorption length l_a .
- Diode Laser with long operating lifetime: wavelength 685 nm, single mode TEM00, 40 mW laser power, low noise <0.5%, coherence length > 1 m, warm up time: 15 min. The laser is completely housed within the RheoLab providing high laser safety for operators (laser class 1).
- Single photon counting APD with detection efficiency > 65%, typ. dead time 20 ns.
- 2 channel fast multi-tau/linear correlator, smallest sampling time 12 ns.
- Two-Cell-Echo technology for measurements with non-ergodic samples such as gels or glasses (Two-Cell-Echo Technology only available from LS Instruments: EU Patent 1720000).
- Temperature controlled sample cell holder operating in the range from 4 to 100°C (standard range) or 4 to 180°C (optional extended temperature range) with $\pm 0.02^\circ\text{C}$ stability. A climate controlled room at or below 23°C required to meet these specifications. For measurements below the dew point a dry air source must be connected. A pressure balanced valve on the backside of the DWS RheoLab allows easy connection of the most common dry air sources.
- Sample cell holder for different optical path length cells 1-10 mm, allowing the use of standard optical cells (available from LS Instruments).
- Sample quantity down to 150 μL (for 1 mm thick sample cell).
- PC (Windows, please contact us if you have specific version requirements) included with flat screen (22") and preinstalled software.
- Total maximum power consumption less than 150 W.
- Options available: DWS particle sizing, backscattering and pseudo cross-correlation for extended frequency range.

