APPLICATION NOTE

MICROTRAC MRB

PARTICLE CHARACTERIZATION

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An Optical Bench Probe Technology for Superior Dynamic Light Scattering Analysis

Why Use a Probe for Dynamic Light Scattering?

Featuring: Particle Size Analysis using a stainless steel probe in the Nanotrac Wave II (in-instrument sample container, including Zeta Potential analysis), Nanotrac Wave II Q (measurement in cuvettes) & Nanotrac FLEX (Dip 'N' Run feature) for Dynamic Light Scattering measurements. All Microtrac DLS instrument use the unique probe design.

Figure 1: Microtrac DLS instruments from left to right: Wave II Q, Nanotrac Flex and Wave //.

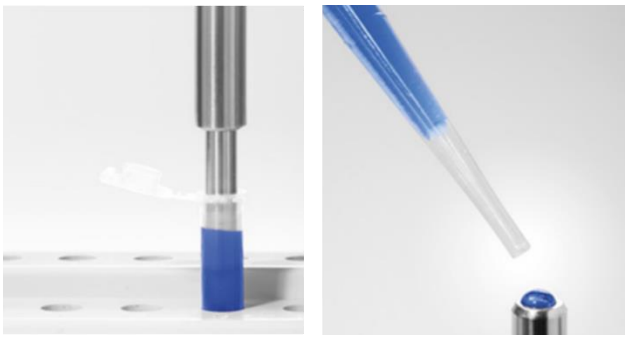

Figure 2: Sample measurement with the Nanotrac flex Dip-In probe. Any vessel can be used as a sample cell, e. g. Eppendorf vials. Measurement of a single drop of sample on the tip of the probe.

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How the Nanotrac Probe works

The Nanotrac products are designed to provide the easiest dynamic light scattering measurement through the use of a specially designed and patented in concert with advanced mathematical concepts and electronics. The probe provides laser light to the sample and also collects the scattered light for data analysis. Light travels through an optical fiber passing through a highly reflective sapphire window at the probe tip. A portion of the laser light is reflected back from a highly reflective sapphire window at the probe tip and travels back through the optical fiber to a photodiode detector. The rest of the light passes through the tip and interacts with the particles, which scatter light back to the same detector. The velocity of the particles imparts a shift in the frequency of the light that undergoes interference with the reflected light, adding the high optical power of the laser to the low optical power of the scattered light.

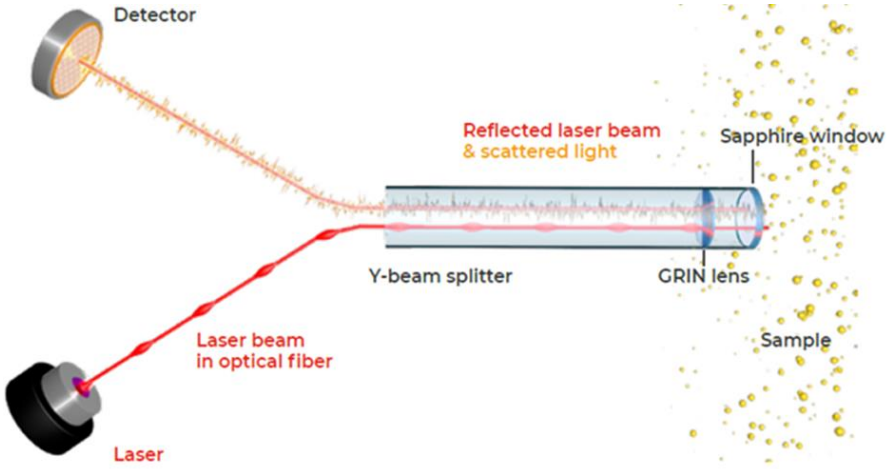

Figure 3: Nanoparticles scatter light from the laser back to the detector along with a reflected portion of the laser beam. The reflected beam adds high power to the low power of the scattered light, which gives up to million times the signal to noise ratio compared to PCS technology.

At the detector, the laser-amplified scatter signal arrives and produces fluctuations in the reported signal. The fluctuating signals are provided to a digital signal processor using a Fast Fourier Transform that converts the signals into a Power Spectrum. The Power Spectrum contains a distribution of frequencies that are inversely proportional to the size of the particles. Further computations and use of Mie scattering considerations provide a full description of the particle size distribution. Thus, the technology has been termed Laser Amplified Detection with Power Spectrum Calculations. See the microtrac.com website for more details on the technology and for sales/applications specialists in your area.

The Table below summarizes the advantages of Microtrac MRB's optical bench probe technology with respect to that of Photon Correlation Spectroscopy.

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Design Issue	Nanotrac Answer	Photon Correlation Spectroscopy Instruments
Requirement for re-focusing or alignment due to cuvette wall optical effects	NONE - EVER	Cell Dependent: background issues, alignment may take as long as 5 minutes per measurement.
Potential for breakage and damage	NONE - EVER	Glass and quartz may fracture
Maintenance costs of expendables	NONE - EVER	Usage Dependent
Contamination from previous usage	Quick rinse avoids issue	Rinse, clean and dry
Transfer need from beaker or vial to cuvette/cell – potential loss of important sample	NONE – Use same container as used for preparation, synthesis or isolation	Transfer required to cuvette or cell
Upfront expense beyond instrument purchase	NONE	Yes
Volume required for measurement	As small as 25λ Range 0.025 – 3 ml with Model 150 1ml to 1000 ml; any shape container with Nanotrac FLEX Flow through for in-line	Typically, 1-3 cc
In-line measurement capability	YES	Generally, no
Need for light to traverse cuvette dimensions Cleanliness of cell issue Limited concentration issue	NONE Background measurement avoids extraneous or ghost peaks High concentration capability	Yes All faces of cuvette must be scrupulously clean Scattering too many times from many particles (multiple scattering) limits concentration and accuracy.
Measurement using various container sizes and shapes	Vial opening diameter must exceed 1 cm for probe immersion. Will fit inside a standard size cuvette.	Limited to specified size cuvette holder
Construction ruggedness	Stainless Steel	Glass or plastic
Sample concentration	Automated, active, on-screen concentration guide to avoid multiple scattering or too low concentrations. Wide range of concentrations permitted.	Limited concentration permitted, estimated guidelines on safe concentrations only. Often only a non-active, “count” determination
Chemical resistance	Compatible with all known organic solvents	Plastic dissolution an issue

For further information please contact us at:

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