



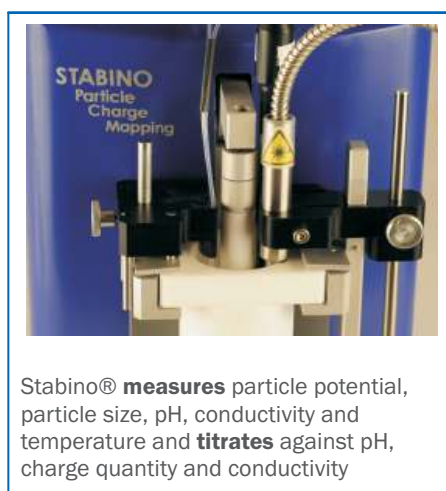
Stabino® & NANO-flex

System for Analysis of
Charge Characteristics and
Size Distribution of Nano-particles

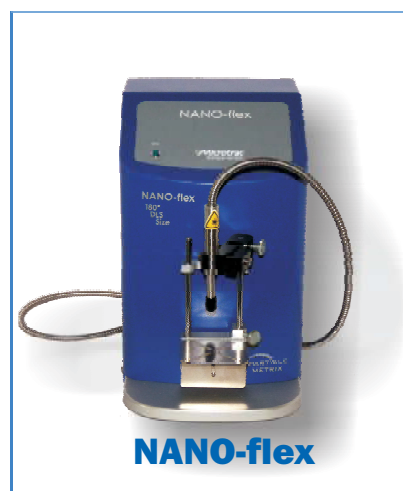
Stabino® & NANO-flex

Rapid Particle Charge Titrations and Size Distribution

In many applications, particle charge and particle size characterise the behaviour of a dispersion. The Stabino® - NANO-flex System is derived from the StabiSizer® - analysis instrument. It provides higher flexibility and is applicable to colloids with particle sizes between sub-nm and 100 µm. Measurements at concentrations up to 40% are possible.



Stabino® **measures** particle potential, particle size, pH, conductivity and temperature and **titrates** against pH, charge quantity and conductivity



Stabino®

Method

The “heart” of the Stabino® is a cylindrical PTFE chamber with an oscillating piston, both carrying only very little anionic charge at the surface (Figure 1). The cylinder contains the 10 mL sample. The addition of titrands is controlled via two incorporated precision titration pumps delivering titrand solution from one or the other reservoir.

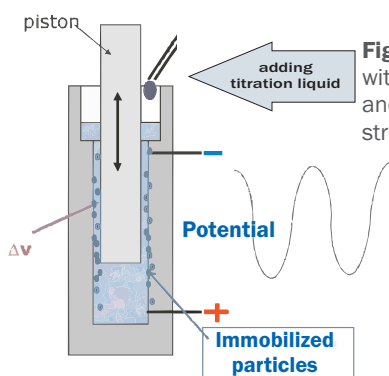


Figure 1: Sample cell with oscillating piston and oscillating streaming potential SP.

A fraction of the particles in the cell is immobilised at the surface of the wall. Therefore, with the piston movement Δv , the mobile cloud of the double layer of the immobilised particles is pushed up and down. That oscillating ion cloud produces an alternating voltage SP = streaming potential at the two electrodes. It is proportional to the zeta potential of the particles.

The Particle Interface Potential, like the streaming potential measured in Stabino®, represents the degree of electrostatic repulsion between particles and reacts to pH, conductivity and the polyelectrolyte surrounding, respectively. Any or all of these parameters can cause a material system to shift. The titration result is characteristic for the sample in a certain chemical environment. A charge titration with the Stabino® specifies which parameters require special attention.

Particle Charge Mapping

The intuitive tablet PC controlled automatic titration of the Stabino opens the way to particle charge finger-printing of colloids and dispersions. The isoelectric point is reached quickly, gathering information on charge density and stable zones, whilst pH, conductivity and temperature are measured simultaneously.

Applications

The sensitivity of the streaming potential depends on surface area. This criterium may be used to follow changes in surface area, as it happens in milling processes. Secondly, the smaller the particles are, the more sensitive the method is.

It is worthwhile to draw the attention to total charge titrations, which reveal the efficiency of ion coating as $\mu\text{C g}^{-1}$ or - if the specific surface is known - as $\mu\text{C m}^{-2}$. It is performed with charge calibrated polyelectrolytes as shown in **Figure 2** with “raw” and modified CNTs.

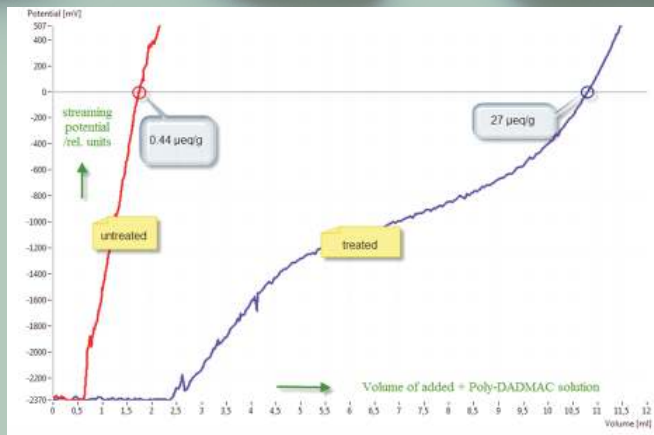


Figure 2:

Total charge titration on CNTs.

Result of the titration:

untreated: $0.44 \mu\text{eq g}^{-1} = 0.042 \text{ C g}^{-1}$.

treated: $27 \mu\text{eq g}^{-1} = 2,61 \text{ C g}^{-1}$.

NANO-flex

Particle Size Distribution

The NANO-flex 180° DLS System measures size distributions in the range of 0.8 nm to 6.5 µm. The applied heterodyne 180° back scattering principle of the Nanotracc® is characterised by its high selectivity in the nano-range and is therefore also suitable for samples with broad size distribution. Highly concentrated samples are measured without interfering multiple scattering.

The applied Nanotracc® back scattering in the NANO-flex is designed as a flexible measuring probe with 8 mm ø. Thus, it can be used in many ways, even in-situ and in the measuring cylinder of the Stabino®!

The 180° DLS-Method

The laser is focused to the sample via an optical fiber and a sapphire window. The window reflects a part of the incoming laser light. Both, laser reflection and scattered light interfere at the detector diode. Due to the excellent signal/noise ratio, there is no need for an expensive detection system.

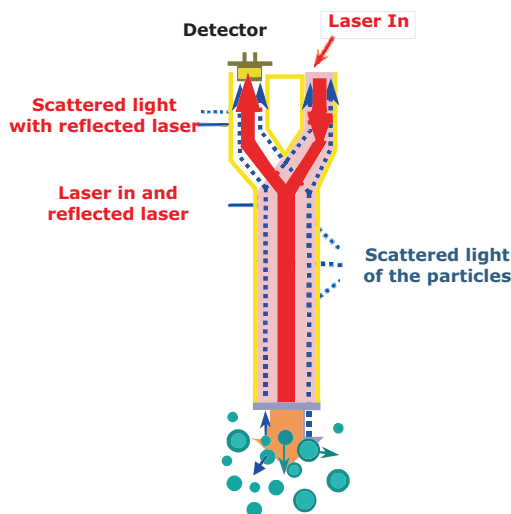


Figure 3:

The described 180° DLS-method.

The fluctuating part of the signal is modulated by the Brownian diffusion of particles and transformed by Fast Fourier into a power spectrum which is referenced by the laser frequency. Without assumption on any distribution model, the size distribution is derived from the power spectrum.

Molecular weight determination according to Debye

Further to the DLS size, a Debye plot feature with automatic dn/dc determination provides molecular weight.

Applications

DLS applications with the NANO-flex module are nearly unlimited, provided the viscosity of the sample is in the Newtonian range, a condition for the free Brownian movement in the fluid and for the accurate calculation of the size. The liquid medium of the particles can be of organic or aqueous nature.

The critical coagulation point of a dispersion can be determined by measurement of size and potential inside Stabino®. For this purpose, the NANO-flex size sensor is dipped into the Stabino® measuring cylinder.

One package for one or two workplaces

Analysis instruments with two methods integrated in one casing often have the disadvantage that they cannot be operated by two different groups. In case of the combination of Stabino® and NANO-flex, a second PC is enough to use both instruments separately.

Simple information as provided by Stabino® and NANO-flex lead rapidly to the desired results.

Please try it!

Stabino® & NANO-flex : Technical Data

Stabino® System for efficient Charge Titrations

Method	streaming potential, calibrated to particle zeta potential or polyelectrolyte charge standards
Titration	two integrated titration pumps
Titration steps	10 µL to 100 µL
Titration modes	fixed and dynamic intervals; cationic/anionic, acid/base, salt, kinetic
Samples	macromolecular solutions and dispersions with up to 100 µm maximum particle size
Sample volume	5 to 10 mL
Sample concentration	0.01 to 40% Vol.
pH-range	2 to 12
pH-meter	included, incl. temperature sensor
Conductivity	automatically measured
Conductivity range	up to 100 mmol KCl conductivity
Potential range	-200 to +200 mV
Supplied standard solvents	0,0025 N PVS (anionic), 0,0025 N Poly-DADMAC (cationic), respectively, and calibrated to charge quantity. Particle standard suspension cationic 50 mV, 10 mL, 30%,w for dilution
Displacement piston	Piston with 0.4 mm and 0.2 mm gap, respectively, measurement accessory
Tablet PC	for controlling the device, for calculation, displaying, exporting and printing data

NANO-flex Particle Sizer and Molecular Weight Analyser

Method No. 1	Dynamic Light Scattering CRM Controlled Reference Method, heterodyne 180°
Analysis No. 1	fast Fourier-Transformation of the frequency power spectrum for size calculation
Method No. 2	Static Light Scattering with integrated dn/dc determination
Analysis No. 2	molecular weight determination according to Debye: 1000 Da - 20 Mio Da
Laser	780 nm, 5 mW
Size range	0.8 nm to 6.5 µm
Probe	single mode fiber with sapphire window as sample interface, probe diameter 8 mm 1 m flexible tube with sensor to dip in in sample vessels, even outside the instrument. Built-in height adjustment of the sample container.
Samples	aqueous and organic macromolecular solutions and dispersions
Temperature range	0 °C to 90 °C, within temperature range from 10 °C to 50 °C with +/- 0,1 °C accuracy
Temperature sensor	Thermistor inside the sensor
PC	Tablet for Stabino® / Laptop for NANO-flex in combination with Stabino®
External dimensions Stabino and NANO-flex without PC	(W x H x D): 180 x 300 (325*) x 260 (340*) mm *) with mounted tubes and cables
Weight without PC, pH-probe and 24 Volt power adapter	Stabino® / NANO-flex - 8 kg / 6 kg
Electrical supply	Stabino® / NANO-flex 24 Volt power adapter, 100 to 240 Volt, 50/60 Hz, 90 VA, 1 kg

CE and ISO 9001 approved.