

Newsletter #5

PARTICLE CHARGE CHARACTERISATION

Proven principles in user friendly instruments



PARTICLE METRIX presents two developments, both capable of combining Particle Interface Potential (PIP) and particle size determinations on colloids. Both, an easy and cost effective entry to particle charge analysis is offered. Typical measurement results are electrostatic dispersion stability, total charge of a dispersion, iso-electric point and dosing information for the control of macromolecular reactions or agglomeration. Except for size measurements in the StabiSizer® there is no need for sample parameters.

Experiments in the **StabiSizer®** are performed on a concentration of particles, whereas in the "seeing is believing" **ZetaView®** many individual particles contribute to the result.



STABISIZER®

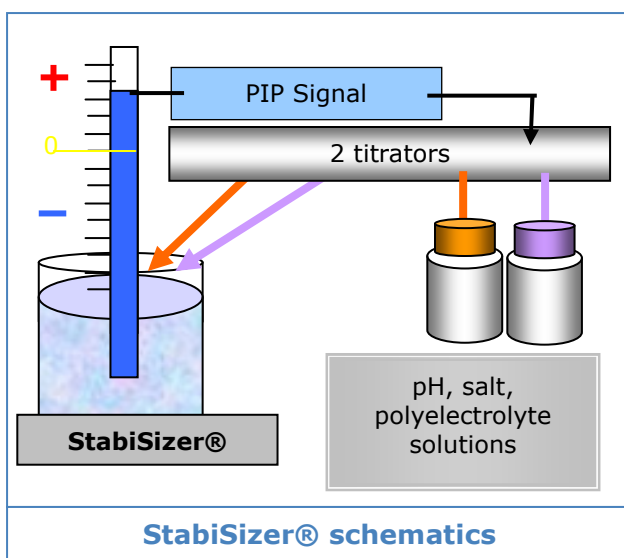
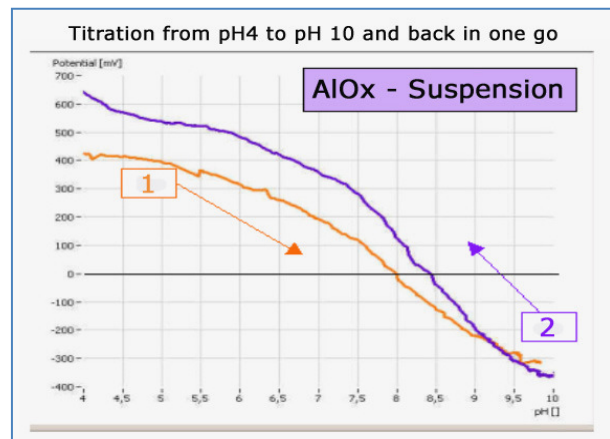
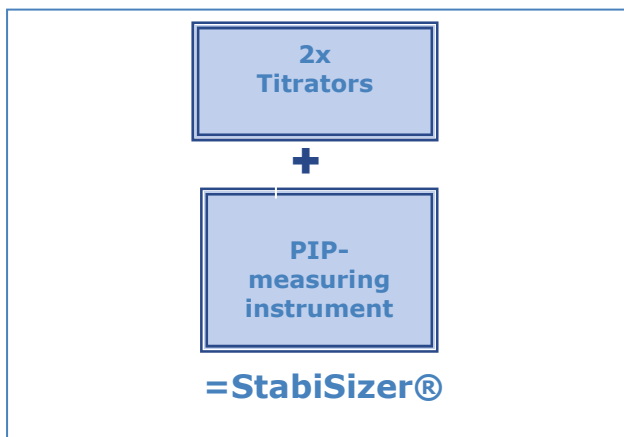


ZETAVIEW®

STABISIZER®

WHY CHARGE TITRATION?

The Particle Interface Potential (PIP) reacts on the presence of surrounding ions in various ways. Some ions have a shielding effect only, others may even induce a polarity reversal of the PIP. Titrations are therefore strongly recommended to fully characterise the electrostatic charge behaviour of the sample. As an example the pH titration on an Al₂O₃ suspension is shown from pH4 to pH10 (1) followed by a titration in the reverse direction (2). Isolated PIP measurements are more or less useless, provided the sample is sufficiently known. The importance of the titration is reflected by the fact that the titrators are incorporated in the instrument.



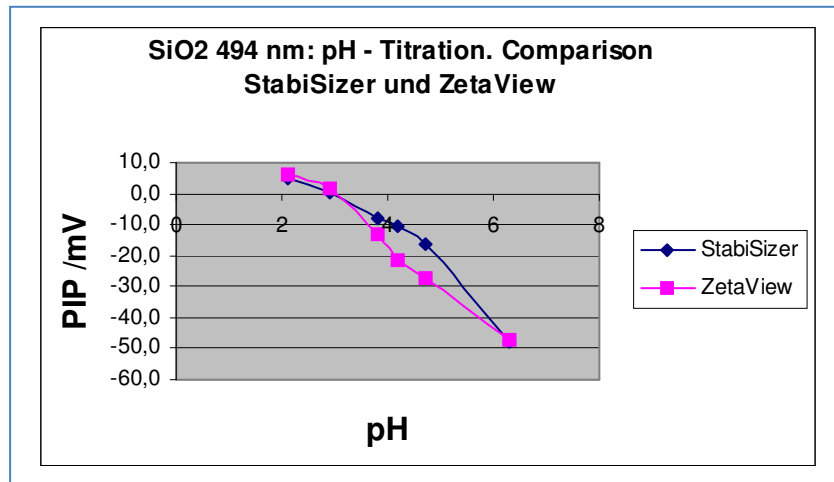
BENEFIT

The StabiSizer® instrument **opens the door to particle charge analysis**. There is no need to invest in particle sizing first. In addition work is simplified by the fact that no sample parameters are required. The two integrated titration units are dedicated to particle charge characterisation work. Bottle changing and sample line cleaning work is minimised by having two titrators. (see schematics on the left side).

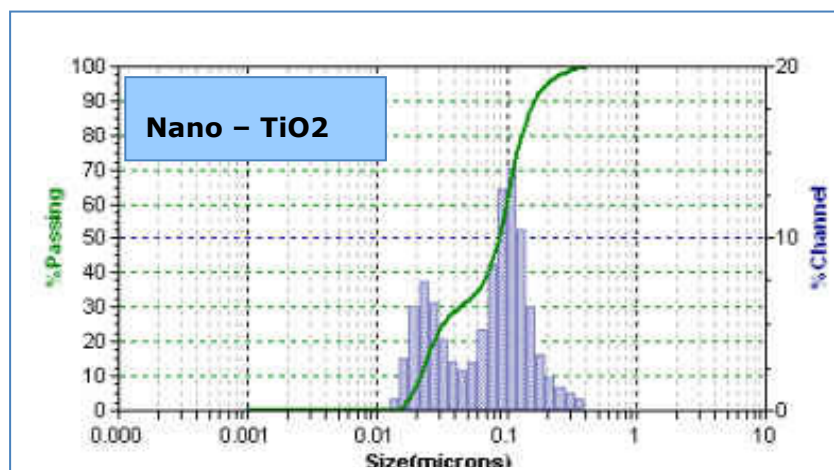
Unique to the streaming potential method is the fact that **macromolecules and nanoparticles below 10 nm** can be easily measured.

The StabiSizer® analyser is therefore capable of measuring **most kind of colloids, particle suspensions and emulsions**.

In many cases the streaming current potential as one kind of a PIP correlates to the Zetapotential. The titration curves therefore show similar characteristic behaviour as **Zetapotential titration** curves (see diagram below).



Optionally, **particle size distribution analysis** (see example below) are possible with an add-on dynamic light scattering **modul** Nanotracc®. It works on the basis of heterodyne backscattering developed by Microtrac Inc. As long as the sample is in the Newtonian viscosity range the sample concentration can be as high as 40%. The size ranges from 0.8 nm up to 6.5 µm. A stainless steel sensing **probe** of 7.8 mm outer diameter with a sapphire window is dipped into any sample beaker (providing the sample is not more than 70 mm below the top of the sample container).

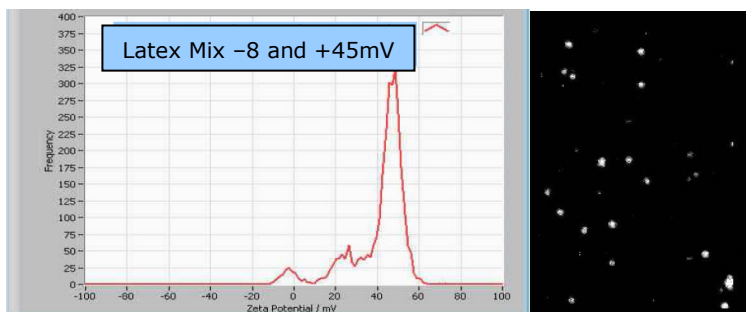


With an **integrated PC** both software packages – charge titration AND particle size distribution analysis can be operated simultaneously. The overlapping of the size and concentration range of the two methods is 0.8 nm to 6.5 µm for size and 0.1 to 10% for the concentration. This is unique compared to many other methods.

APPLICATIONS

Applications for the particle charge titrations are in two main fields: process optimisation and dispersion stability formulation. Nanoparticle synthesis, flocculation, nanomilling chemistry are examples of process optimisation. In sectors like proteins, liposomes, polymers, coatings, polishing and nano metals the stability consideration is the main interest.

ZETAVIEW®



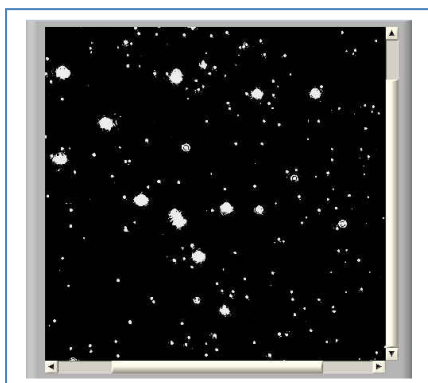
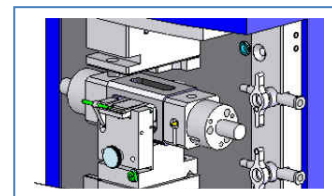
Zetapotential distribution, directly viewed in the laser scattering video microscope

PRINCIPLE

Direct video analysis of the electrophoretic motion gives the Zetapotential distribution (left). The Brownian motion is used to calculate the particle size distributions. To visualise the small colloidal particles a laser illuminates the focal plane of a microscope. The size range is 0.08 to 50 µm for Zetapotential and 0.08 to 0.6 µm for size distribution analysis

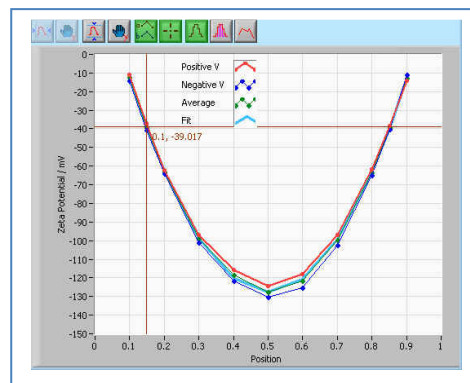
BENEFIT

To make the routine work in R&D and QC attractive, **reproducibility and ease of operation** are required. For an electrophoresis set-up the ZetaView® has two unique features: These are cell position reproducibility to a few micrometers and auto-alignment / autofocus. This is critical for an easy cell change and for repeatable results.



Left: Mix of 420 nm and 1000 nm Latex-particles

Right: Mobility profile between the inner cell walls (0) being the wall next to the microscope and (1) the remote wall.



The judgement on the **measurement quality** is greatly eased by direct observation (left) of the particles in the cell. For further studies mobility profiles through the cross section of the electrophoresis cell (right) are useful.

APPLICATIONS

There is a wide field of applications for both research and QC work. These include nano diamond suspensions, protein suspensions, fibre suspensions and emulsions.

SUMMARY

With the unique instruments **ZetaView®** and **StabiSizer®** **PARTICLE METRIX** offers an easy entry into routine particle charge analysis. Customers already equipped with size instrumentation may invest directly into our charge characterisation instruments without having to purchase a particle size instrument. The modular design of our instruments allows the combination of both charge and size.