Electrokinetic Sonic Amplitude for Advanced Process Analysis of Concentrated Nano Dispersions Under Process Conditions

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Electrokinetic Sonic Amplitude (ESA)

The ESA method is an electro acoustic measuring technique for characterising the charge stability of particles in dispersion. An oscillating voltage, generated by an AC source, is applied to suspension, dispersion, or emulsions.
Charged particles in dispersion vibrate with the frequency of an applied electric field.
The amplitude of these sound waves gives the Electrokinetic-Sonic-Amplitude (ESA). The ESA signal is proportional to the dynamic mobility of the particle, which in turn is proportional to the zeta potential of the particles in dispersion.

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$$\zeta = \frac{ESA * \eta}{\phi * \Delta\rho * c * |G(\alpha)| * \varepsilon}$$

ESA: *Elektrokinetic Sonic Amplitude*
Φ: *Volume fraction*
Δρ: *Density difference between particle and dispersed phase*
C: Acoustic velocity
η: *Viscosity of fluid (0, 89 cP minus 2 % per °C deviation from 25 °C)*
ε:: *Dielectric constant of dispersion*
I*G(α)*I: Inertance correction

Technical Application: TiO_2-Pigments

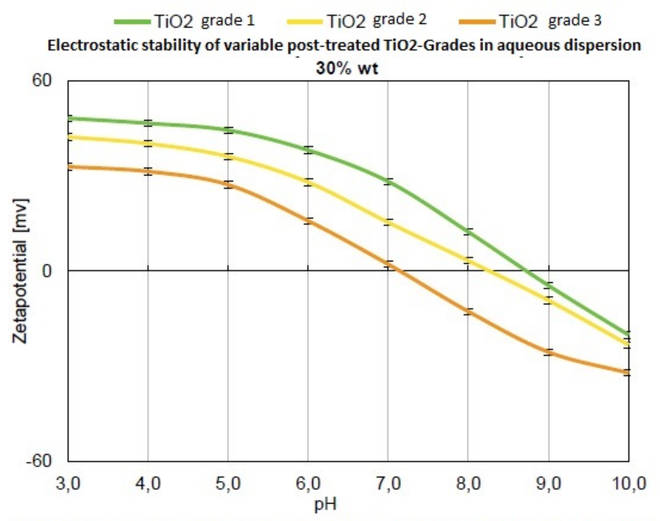
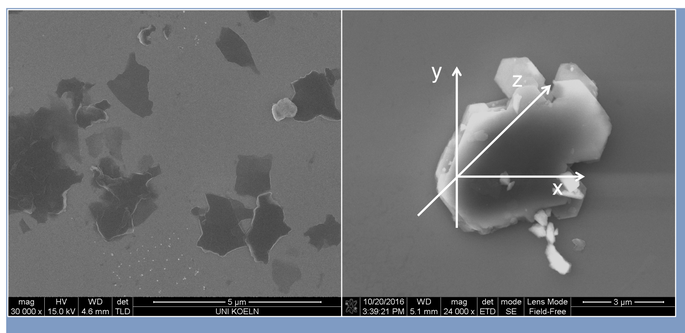


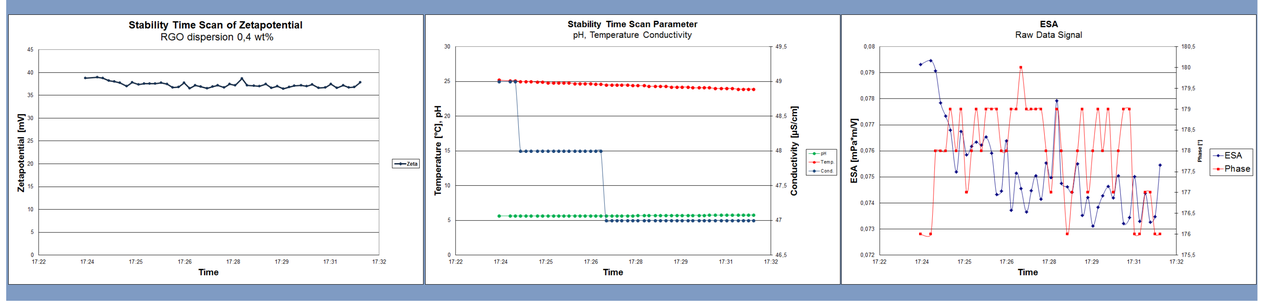
Fig.1: Zeta-potential of three variable post-treated TiO2-Grades in aqueous dispersion with a concentration of 30 wt%. Measured with method of Electrokinetic-Sonic-Amplitude ESA.

TiO2-pigments grades with different
kinds of post-treatment in aqueos dispersion were measured.
They differ in isoelectric point IEP and with regard to their zetapotential significantly from each other.
Further **Applications:**
Ceramic, Paints & Inks, Semiconductors, Dyes, Cement, Papers, Wet milling, Control of post treatment, Nano –dispersions, Catalysts and Zeolites.

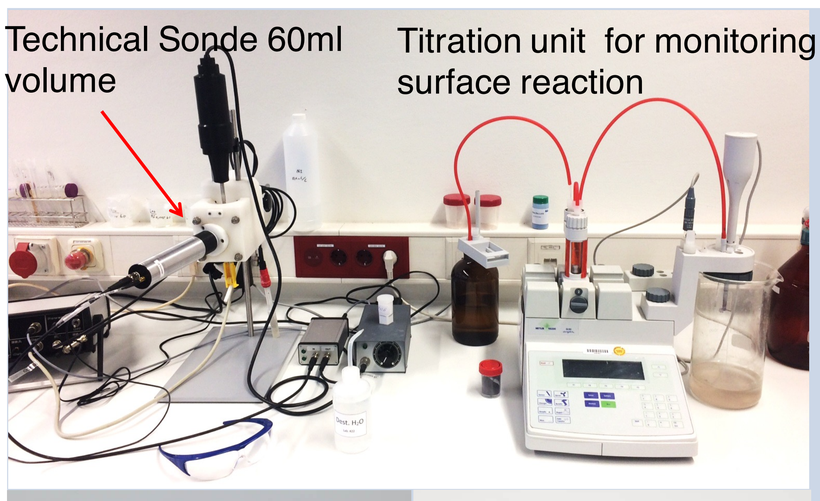
Scientific Application: Graphene Oxides



Flaky graphene particles are oszillating under statistic angle. The mean value, combined of suface and edge charge, is detected. This is an advantage in measuring particles with non circularly particle shapes.



Experimental Setup



Titration experiments under process conditions:
- Stability data
- Varying pH
- Various surfactants
- High concentrations
- Sedimentation Samples
- Temperatures up to 90°C

Dispersing phases:
- Aqueous
- Alcoholic
- Orcanic

Summary & Outlook

The ESA technique is the most modern electro acoustic methods and has been developed for a whole range of different applications.
Various process conditions can be involved in the stability analysis via ESA.
The results of the analysed highly concentrated samples correlate directly with the electro kinetic properties of the dispersed particle in both, the raw material and the final product.
Application orientated contract Dispersion Research for Process intensivation is carried out by Materials Alliance Cologne.

Materials Alliance Cologne

The Steinbeis Transfer Centre **Materials Alliance Cologne** is situated at the Institute of Inorganic Chemistry of the University of Cologne (Germany) and is embedded in the network of the **Steinbeis GmbH** (Stuttgart, Germany) with over 1,000 Transfer Centers operating worldwide. Our expertise is the synthesis, modification and characterization of nanostructured materials including their molecular precursors.

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