EKA
Electro Kinetic Analyzer
EKA
Zeta Potential Determination

What makes raindrops remain intact on certain surfaces? This effect is described by electrophoretic phenomena which can be investigated via zeta potential measurements. The Electro Kinetic Analyzer enables the investigation of electrophoretic effects at the solid/liquid interface for solids of almost all shapes and sizes.

Zeta potential gives insight into the charge and adsorption properties of various surfaces. The magnitude of the zeta potential is directly related to the magnitude of the surface charge and so the zeta potential measurement reflects surface charge properties very well.

Zeta potential aids scientists in the fields of chemistry and materials science to improve or diminish defined surface properties and design new, specialized material properties e.g. for polymers, textiles, ceramics, glass and shampoos.

Measuring Cells

Cylindrical Cell
The easy to handle glass cell is mainly used for fibers, granules, powders, particles, pulp, paper and hair.

Powder Cell
The powder cell is specially designed to measure particles which are too dense or too large to be measured with electrophoretic devices. The powder cell is inserted into the cylindrical cell for powders smaller than 200 µm (pigments, granules).

Rectangular Cell
The rectangular cell is the classical tool used with the EKA for measuring plane surfaces like foils, polymer sheets, membranes, metals, ceramics and glass. The sample is clamped between the two measuring cell parts separated by a defined streaming channel.

Clamping Cell
The clamping cell enables the measurement of plane structural parts without cutting the sample. Metallic, ceramic, polymeric and glass materials of different thickness and shape can be measured easily on site if required.
Principle of the electrochemical double layer

In water, electrically charged materials such as solids of nearly any shape (fibers, particles, powders, plates, foils) form an electrochemical double layer. The material’s surface, which is oriented towards the liquid solution is covered by a “charge cloud”. The formation of this “charge cloud” is called the electrochemical double layer. The electrochemical double layer is divided into the immobile Stern layer and the mobile or diffuse layer. A plane of shear separates the layers from each other.

During relative motion of a part of this “charge cloud”, the diffuse layer is sheared off. The zeta potential can be measured during the relative motion of the diffuse layer towards the solid’s surface with its fixed charges (immobile layer).

Measuring Principle

The zeta potential measurement is based on a streaming potential/streaming current (dU/dp; dI/dp) method. An electrolyte solution is pumped via an electrolyte circuit through the measuring cell containing the sample. Due to the pressure difference and the relative movement of the charges in the electrochemical double layer, the streaming potential can be detected via electrodes placed at both sides of the sample.

The temperature, conductivity and pH value are determined simultaneously. A user-friendly control and evaluation software collects all measured parameters and automatically calculates the zeta potential. The values obtained are shown as graphs and tables. The various available measuring cells allow a wide range of different materials to be investigated.
Chemical and physical surface modification
- Coatings and surface treatments
- Printing, paint and varnish industry
- Pulp and paper
- Polymer processing
- Cosmetics (shampoos, conditioners)
- Membranes and filters
- Synthetic and natural fibers and textiles
- Semiconductor industry
- Mineral powders
- Glues

Application example

Membrane fouling in water purification is a well-known problem. By measuring the zeta potential of defined membranes, the effect of foulants e.g. divalent cations and anions can be investigated. Based on the measuring results, the membrane surface can be specifically treated to decrease membrane fouling and extend the membrane lifetime.

Graph 1: Effect of divalent cations and anions on a nanofiltration membrane.
The graph shows clearly that the magnitude of the zeta potential decreases with the increasing amount of divalent cations and anions in the electrolyte solution.

ISOELECTRICAL POINTS

NANOFILTRATION MEMBRANES
System Configuration

The EKA is used in combination with a remote titration unit (RTU). This set-up allows fully automatic zeta potential measurements in dependence on pH or additive concentration.

The EKA must be connected to a personal computer via the RS 232 interface.

Specifications

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>Streaming Potential</th>
<th>0 . . . . . . 2000 mV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Streaming Current</td>
<td>0 . . . . . . 2000 nA</td>
</tr>
<tr>
<td></td>
<td>Pressure</td>
<td>0 . . . . . . 1000 mbar</td>
</tr>
<tr>
<td></td>
<td>Conductivity</td>
<td>1 µS/cm . . . 200 mS/cm</td>
</tr>
<tr>
<td></td>
<td>pH</td>
<td>pH 0.00 . . . pH 14.00</td>
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<tr>
<td></td>
<td></td>
<td>(-500.0 . . . +500.0 mV)</td>
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<tr>
<td></td>
<td>Temperature</td>
<td>10 . . . . . . 50 °C</td>
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<tr>
<td></td>
<td>Pump capacity</td>
<td>approx. 1.7 L/min</td>
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<tr>
<td>Electrolyte solution</td>
<td>pH value</td>
<td>pH 2 . . . . pH 12</td>
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<tr>
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<td>Conductivity</td>
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<tr>
<td></td>
<td>Temperature</td>
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<tr>
<td>Data interface</td>
<td>RS 232-C (PC-interface)</td>
<td></td>
</tr>
<tr>
<td>Measuring Cells</td>
<td>Cylindrical Cell</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rectangular Cell</td>
<td></td>
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<tr>
<td></td>
<td>Clamping Cell</td>
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<td></td>
<td>Powder Cell Insert</td>
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<tr>
<td>Mechanical Data</td>
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<td>520 mm x 530 mm x 420 mm (W x H x D)</td>
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<tr>
<td></td>
<td>Weight</td>
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<tr>
<td>Mains Supply</td>
<td>Power Supply</td>
<td>110/115/230 V AC, 50 . . . . 60 Hz</td>
</tr>
</tbody>
</table>
Instruments for:
Density & concentration measurement
Rheometry and viscometry
Sample preparation
Colloid science
Microhardness testing
X-ray structure analysis
CO₂ measurement
High-precision temperature measurement