Brookhaven ZetaPALS Phase Analysis Light Scattering

100 Times more sensitive leads to Zeta Potential measurements where others fail... in organic solvents, high salt suspensions, oils, near I.E.P., viscous fluids

For the difficult cases
For measurements of very low mobilities, the Brookhaven ZetaPALS is the answer. The only answer! With concepts developed at Bristol University and Brookhaven Instruments, the ZetaPALS determines zeta potential using Phase Analysis Light Scattering: A technique that is up to 100 times more sensitive than traditional light scattering methods based on the shifted frequency spectrum.

Electrostatic repulsion of colloidal particles is often the key to understanding the stability of any dispersion. A simple, easy measurement of the electrophoretic mobility --even in nonpolar liquids-- yields valuable information. Measurements made in water and other polar liquids are easy and fast with the Brookhaven ZetaPlus. Such measurements cover the range of typically ± 6 - 100 mV, corresponding to mobilities of ± 0.5-8x10^8 m^2/V·s. The ZetaPALS covers this full range, of course, and extends it by a factor of 100 in sensitivity!

Features at a Glance
- Zeta potential for the difficult cases...
- in organic solvents, oily or viscous media
- in high salt suspensions
- near I. E :P.
- 100 times more sensitive than other techniques
- disposable cuvettes, no contamination or alignment
- built in automatic procedures and parameters
- easy to use; complete with internal PC
- upgradeable to include full particle sizing functionality

Principles of Operation:
The ZetaPALS utilizes phase analysis light scattering to determine the electrophoretic mobility of charged, colloidal suspensions. Unlike its cousin, Laser Doppler Velocimetry (LDV) (sometimes called Laser Doppler Electrophoresis (LDE)), the PALS technique does not require the application of large fields which may result in thermal problems. Because in the measurement of phase shift, the particles need only to move a fraction of their own diameter to yield good results.

In salt concentrations up to 3 molar and with electric fields as small as 1 or 2 V/cm enough movement is induced to get excellent results. In addition, the Autotracking feature compensates for thermal drift.

Simple clear presentation:
The screen image above shows the results of an actual experiment with a ZetaPALS instrument. The important parameters and results are seen at a glance. The excellent agreement of the ten runs in this experiment is obvious as is the match of experimental curve (red) and it’s parametrized version (blue). As with all Brookhaven instruments the user can simply produce a customized report.

Something more challenging:
Of course the ZetaPALS can quickly and easily yield results from all "regular" samples but it’s real strength is in the difficult cases and to demonstrate the performance of this premium instrument where others fail – we offer the following table.
Electrophoretic Mobilities Determined with the ZetaPALS (units $10^{-8} \text{ m}^2/\text{V} \cdot \text{s}$)

<table>
<thead>
<tr>
<th>Sample</th>
<th>PALS Result</th>
<th>Lit. Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIST 1980</td>
<td>2.51 ± 0.11</td>
<td>2.53 ± 0.12</td>
<td>Electrophoretic mobility standard.</td>
</tr>
<tr>
<td>Blood Cells</td>
<td>-1.081 ± 0.015</td>
<td>-1.08 ± 0.02</td>
<td>Dispersed in physiological saline</td>
</tr>
<tr>
<td>Fe$_2$O$_3$</td>
<td>0.013 ± 0.0015</td>
<td>N.A.</td>
<td>Dispersed in dodecane</td>
</tr>
<tr>
<td>TiO$_2$</td>
<td>0.255 ± 0.010</td>
<td>N.A.</td>
<td>Dispersed in toluene - not dried</td>
</tr>
<tr>
<td>TiO$_2$</td>
<td>0.155 ± 0.011</td>
<td>N.A.</td>
<td>Dispersed in toluene - dried</td>
</tr>
<tr>
<td>TiO$_2$</td>
<td>-0.503 ± 0.0015</td>
<td>N.A.</td>
<td>Dispersed in ethanol</td>
</tr>
<tr>
<td>Casein</td>
<td>-0.025 ± 0.002</td>
<td>N.A.</td>
<td>Dispersed in PEG - viscous</td>
</tr>
<tr>
<td>SiO$_2$</td>
<td>-0.73 ± 0.04</td>
<td>N.A.</td>
<td>Dispersed in 2.0 M KCl - High salt</td>
</tr>
</tbody>
</table>

Aggressive solvents

such as DMF, THF, DMSO, MEK etc are easily accommodated by the BIC ZetaPALS system with the use of our special solvent resistant electrodes and glass sample cells. The extension of zeta potential measurements into the realm of such systems is just another standout property of the BIC ZetaPALS.

Unusual solvent?

If your solvent is unusual then it's dielectric constant is probably unknown. In this case our BI-870 Dielectric Constant Meter will quickly easily and accurately provide the information necessary for a zeta potential measurement.

Additional Capabilities

Of course every ZetaPALS system also contains a complete ZetaPlus system and this has the special ability to characterize multimodal zetapotential distributions if they exist. The ZetaPALS instrument is also available with the full capability of our model 90Plus Particle Sizer and this combination instrument provides a benchtop particle characterization center of great power.

Specifications:

- **Type:** Most colloidal samples suspended in any transparent liquid.
- **Size Range:** Material dependent, For electrophoresis 0.005 to 30 microns; For optional particle sizing, <0.0006 to 6 microns.
- **Volume:** 1 mL to 1.5 mL, optional 10 µL for particle sizing only.
- **pH Range:** 1 to 13.
- **Conductivity Range:** 0 to 20 S/m.
- **Mobility Range:** $10^{-11}$ to $10^{-7} \text{ m}^2/\text{V} \cdot \text{s}$
- **Temperature Range:** -10 °C to 140 °C +/- 0.1 °C., active control; no external circulator required
- **Measurement Duration:** 10 to 250 s, typically 30 s.
- **Laser:** 35 mW (raw laser power), 50 mW optional.
- **Field strength:** 0 to 60 kV/m, either automatic or by manual selection.
- **Electrodes:** Palladium with acrylic supports; for reactive samples special solvent resistant electrodes assemblies are available.
- **Cells:** Disposable plastic, or glass or quartz.
- **Input power:** 100/115/220/240 VAC; 50/60 Hz; 300 Watts.
- **Dimensions:** 267(H) x 435(W) x 445(D) mm. (excluding monitor)
- **Weight:** 27 kg (excluding monitor)

*A policy of continual improvement may lead to specification changes.*