TECH TIP 08

Advantages of a Multi-point Zeta Potential Measurement

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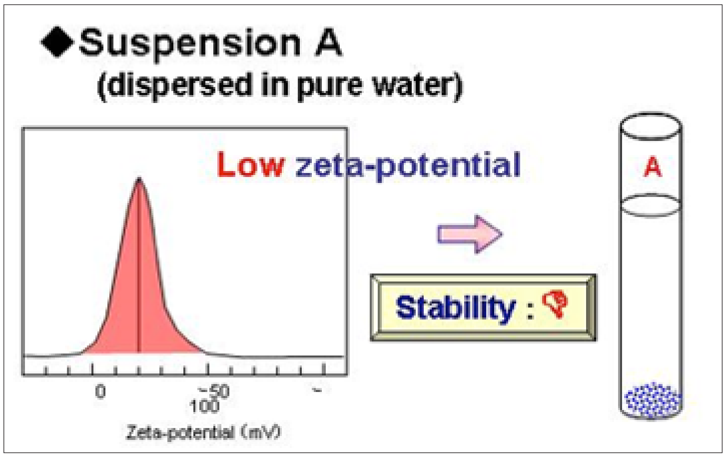
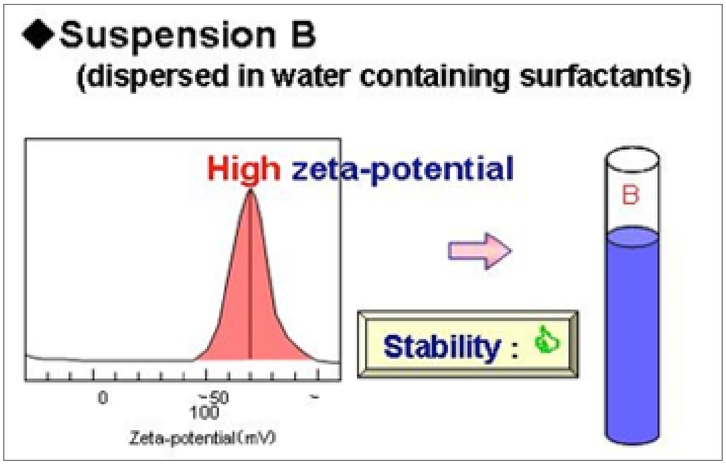
Introduction

Zeta potential is characteristic of the stability of a suspension. The closer a zeta potential value gets to 0 mV, the suspension becomes more unstable. This means that the ionic charge in the system is so that it will allow the particles to attract to each other and form larger particles and, at some point, possibly settle out of the medium, as illustrated in Suspension A versus Suspension B.

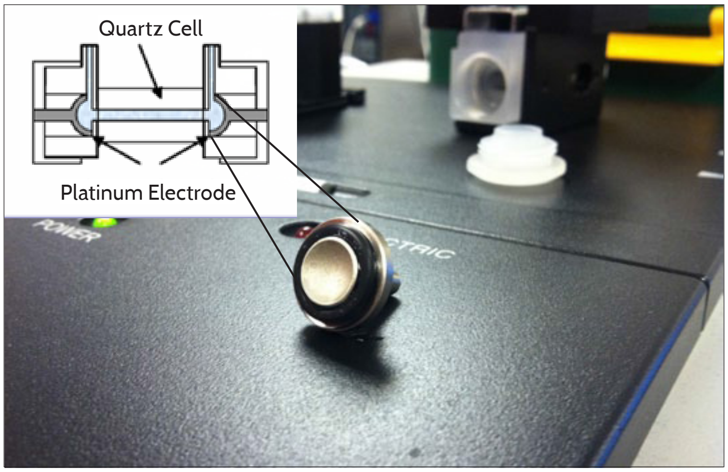




Zeta potential is measured by Electrophoretic Light Scattering (ELS). In ELS, the sample suspension is introduced into a specialized cell with two parallel electrodes. The electrodes generate an electric field and the particles will shift towards one electrode or the other. A laser with a known base frequency strikes the particles and a Doppler-shift in the frequency caused by the shifting particles is detected. A mobility is then calculated, from which a zeta potential can be calculated.

In order to maintain a stable laser beam to make the measurements, the NanoPlus uses a long lasting 30mW laser diode, rather than a traditional He-Ne laser source that is sensitive to the temperature of the environment. The higher powered diode laser also improves accuracy and repeatability of the measurement.

Heating at the electrode surface can damage the particles or the liquid medium. In order to prevent heating at the electrode surface, the NanoPlus electrodes are dome-shaped to focus the electric field towards the center of the cell, as illustrated below.



Particulate Systems
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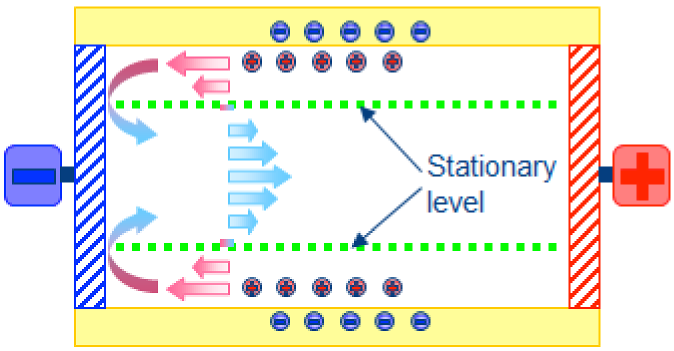
As the particles shift towards an electrode, a number of factor could hinder their mobility. First, the sides of the cell have some surface charge associated with them. This charge can attract the particles to it and impede the mobility close to the surface.To minimize this, the NanoPlus cell is flat and the electrodes are parallel, instead of a U-shaped cell. This also minimized the distance between the electrodes. To further combat this drag effect, the NanoPlus measures mobility at five (5) different heights in the cell. An algorithm is then used to calculate a true mobility of the particles, taking into account the height of the measurement, the electric field strength, and the liquid properties.



Effects of Surface Charge of cell and Electroosmotic flow

A second factor that may hinder the particle mobility is electroosmosis. Electroosmosis occurs when the particles are moving towards an electrode, they are displacing some liquid. Since the electric field is focused at the center of the cell, the particles at the center of the cell will have the greater mobility. As the center particles move, the liquid they displace pushes against the sides of the cell and in the opposite direction. This back flow of the liquid medium will then have an additional backwards force against the particles closer to the sides of the cell. Again, measuring the mobility at five (5) different heights negates this electroosmotic effect and provides greater confidence in the true mobility of the particles.

Conclusion

Systems that do not take into account effects of the surface charge of the sides of the cell and electroosmosis will report an apparent mobility which may require verification using the NanoPlus. Furthermore, systems that only measure at one (1) height in the cell have no practical way to verify the results.