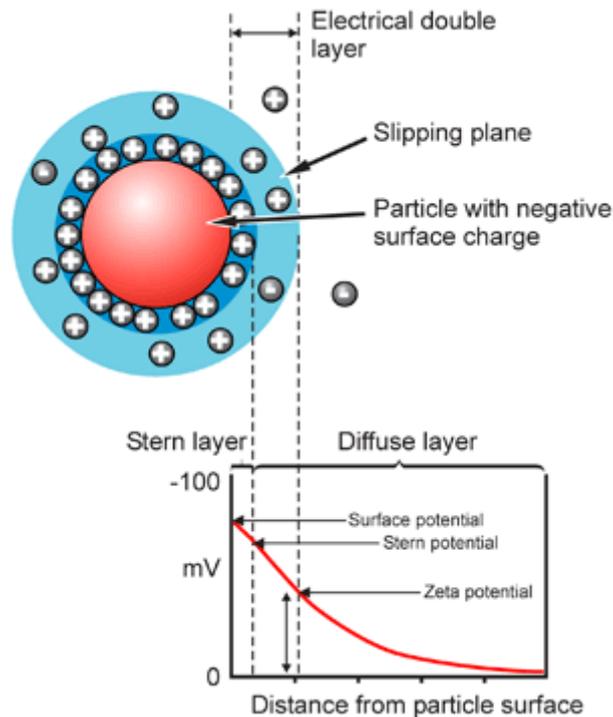


EXPERIMENT #3

Zeta potential measurement of particles in aqueous suspensions

Zeta potential is used to assess the charge stability of a disperse system, and assist in the formulation of stable products. Zeta potential may be related to the surface charge in a simple system, but equally well may not. The zeta potential can even be of opposite charge sign to the surface charge. One of the most important lessons is that it is the zeta potential that controls charge interactions, not the charge at the surface.



Schematic representation of zeta potential

Most particles dispersed in an aqueous system will acquire a surface charge, principally either by ionization of surface groups, or adsorption of charged species. These surface charges modify the distribution of the surrounding ions, resulting in a layer around the particle that is different to the bulk solution. If the particle moves, under Brownian motion for example, this layer moves as part of the particle. The zeta potential is the potential at the point in this layer where it moves past the bulk solution. This is usually called the slipping plane. The charge at this plane will be very sensitive to the concentration and type of ions in solution.

Zeta potential is one of the main forces that mediate interparticle interactions. Particles with a high zeta potential of the same charge sign, either positive or negative, will repel each other. Conventionally a high zeta potential can be high in a positive or negative sense, i.e. $<-30\text{mV}$ and $>+30\text{mV}$ would both be considered as high zeta potentials. For molecules and particles that are small enough, and of low enough density to remain in suspension, a high zeta potential will confer stability, i.e. the solution or dispersion will resist aggregation.

Method

In the experiment electrical field is used for measurement of zeta potential. In this method, zeta potential is measured by applying an electric field across the dispersion. Particles within the dispersion with a zeta potential will migrate toward the electrode of opposite charge with a velocity proportional to the magnitude of the zeta potential. The velocity of moving particles is measured as the particle mobility, and this mobility is converted to the zeta potential by inputting the dispersant viscosity, and the application of the Smoluchowski or Huckel theories.

(http://www.malvern.com/LabEng/technology/zeta_potential/zeta_potential_LDE.htm)

Equipment, accessories and materials:

Zeta Meter 3+
Calcite mineral
Distilled water

Experimental Procedure:

Prepare a suspension of 0.1 % wt. using calcite with distilled water. Slowly add the suspension into the standard zeta meter cell. Be careful not to leave any trapped air bubbles after inserting the rod type platinum cathode and cylinder type molybdenum anode rubber caps of the cell. Adjust the microscope (magnification and fine adjustment) to visually see the particles. Meanwhile, move the cell such that it positions between the center of two parallel light lines. Monitor the particles using the microscope by naked eye and wait for sufficient time to obtain a stable suspension in which there is no moving particle. Upon getting a stable suspension, apply an electric field across the suspension. Particles move either to left or right side depending on the sign of the particles. Measure the velocity of particles by pressing the right or left button on the zeta meter timer upon which the microprocessor directly gives the zeta potential value calculated according to Smoluchowski theory.

Report:

- Give an information about zeta potential measurement methods.
- Compare your result obtained from Zeta Meter 3+ with the expected zeta potential of calcite from literature and comment on differences.
- Discuss the potential source of errors that might lead to deviations from the true value.