**Electrophoresis**

[Electrophoretic mobility](https://en.wikipedia.org/wiki/Electrophoretic_mobility) is proportional to electrophoretic velocity, which is the measurable parameter. There are several theories that link electrophoretic mobility with zeta potential. They are briefly described in the article on [electrophoresis](https://en.wikipedia.org/wiki/Electrophoresis) and in details in many books on colloid and interface science. There is an IUPAC Technical Report[[10]](https://en.wikipedia.org/wiki/Zeta_potential#cite_note-10) prepared by a group of world experts on the [electrokinetic phenomena](https://en.wikipedia.org/wiki/Electrokinetic_phenomena" \o "Electrokinetic phenomena).

From the instrumental viewpoint, there are three different experimental techniques: [microelectrophoresis](https://en.wikipedia.org/wiki/Microelectrophoresis" \o "Microelectrophoresis), [electrophoretic light scattering](https://en.wikipedia.org/wiki/Electrophoretic_light_scattering) and [tunable resistive pulse sensing](https://en.wikipedia.org/wiki/Tunable_resistive_pulse_sensing). Microelectrophoresis has the advantage of yielding an image of the moving particles. On the other hand, it is complicated by [electro-osmosis](https://en.wikipedia.org/wiki/Electro-osmosis) at the walls of the sample cell. Electrophoretic light scattering is based on [dynamic light scattering](https://en.wikipedia.org/wiki/Dynamic_light_scattering). It allows measurement in an open cell which eliminates the problem of electro-osmotic flow except for the case of a capillary cell. And, it can be used to characterize very small particles, but at the price of the lost ability to display images of moving particles. Tunable resistive pulse sensing is an impedance based measurement technique that measures the zeta potential of individual particles based on the duration of the resistive pulse signal.[[11]](https://en.wikipedia.org/wiki/Zeta_potential#cite_note-Zeta_Potential_Measurement_-_Izon_Science-11) The translocation duration of nanoparticles is measured as a function of voltage and applied pressure. From the inverse translocation time versus voltage dependency electrophoretic mobility and thus zeta potentials are calculated. The main advantage of the TRPS method is that it allows for simultaneous size and surface charge measurements on a particle-by-particle basis, enabling the analysis of a wide spectrum of synthetic and biological nano/microparticles and their mixtures.

All these measuring techniques may require dilution of the sample. Sometimes this dilution might affect properties of the sample and change zeta potential. There is only one justified way to perform this dilution - by using equilibrium supernatant. In this case the interfacial equilibrium between the surface and the bulk liquid would be maintained and zeta potential would be the same for all volume fractions of particles in the suspension. When the diluent is known (as is the case for a chemical formulation), additional diluent can be prepared. If the diluent is unknown, equilibrium supernatant is readily obtained by centrifugation.

**Electroacoustic phenomena**

There are two electroacoustic effects that are widely used for characterizing zeta potential: [colloid vibration current](https://en.wikipedia.org/wiki/Colloid_vibration_current) and [electric sonic amplitude](https://en.wikipedia.org/wiki/Electric_sonic_amplitude), There are commercially available instruments that exploit these effects for measuring [dynamic electrophoretic mobility](https://en.wikipedia.org/wiki/Dynamic_electrophoretic_mobility), which depends on zeta potential.

Electroacoustic techniques have the advantage of being able to perform measurements in intact samples, without dilution. Published and well-verified theories allow such measurements at volume fractions up to 50%, see reference. Calculation of zeta potential from the dynamic electrophoretic mobility requires information on the densities for particles and liquid. In addition, for larger particles exceeding roughly 300 nm in size information on the particle size required as well.

**Applications of Zeta Potential**

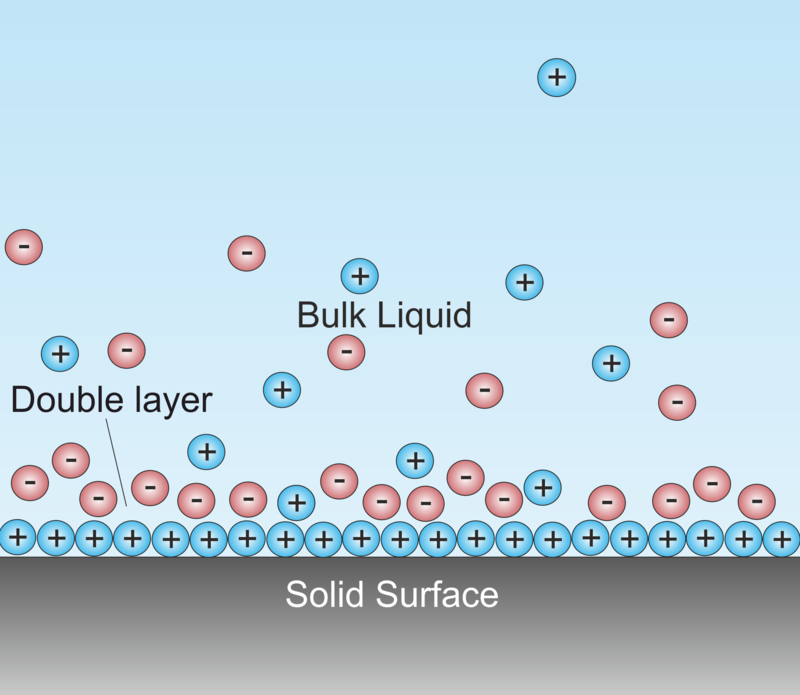
Since the physical properties of suspensions and colloids largely depend on the properties of the particle-liquid interface, knowing the zeta potential has practical applications.

**Zeta Potential Measurements are used to**

* Prepare colloidal dispersions for cosmetics, inks, dyes, foams, and other chemicals
* Destroy undesirable colloidal dispersions during water and sewage treatment, preparation of beer and wine, and dispersing aerosol products
* Reduce cost of additives by calculating the minimum amount needed to achieve the desired effect, such as the amount of flocculant added to water during water treatment
* Incorporate colloidal dispersion during manufacturing, as in cements, pottery, coatings, etc.
* Utilize desirable properties of colloids, which include capillary action and detergency. Properties may be applied for mineral flotation, impurity absorption, separating petroleum from reservoir rock, wetting phenomena, and electrophoretic deposition of paints or coatings
* Microelectrophoresis to characterize blood, bacteria, and other biological surfaces
* Characterize the properties of clay-water systems
* Many other uses in mineral processing, ceramics manufacturing, electronics manufacturing, pharmaceutical production, etc.

**Double Layer**

* A **double layer** (**DL**, also called an **electrical double layer**, **EDL**) is a structure that appears on the surface of an object when it is exposed to a fluid. The object might be a solid particle, a gas bubble, a liquid [droplet](https://en.wikipedia.org/wiki/Droplet), or a [porous body](https://en.wikipedia.org/wiki/Porous_media). The DL refers to two parallel layers of charge surrounding the object. The first layer, the [surface charge](https://en.wikipedia.org/wiki/Surface_charge) (either positive or negative), consists of ions [adsorbed](https://en.wikipedia.org/wiki/Adsorbed) onto the object due to chemical interactions. The second layer is composed of ions attracted to the surface charge via the [Coulomb force](https://en.wikipedia.org/wiki/Coulomb_force), electrically [screening](https://en.wikipedia.org/wiki/Electric-field_screening) the first layer. This second layer is loosely associated with the object. It is made of free ions that move in the fluid under the influence of [electric attraction](https://en.wikipedia.org/wiki/Electromagnetism) and [thermal motion](https://en.wikipedia.org/wiki/Thermal_motion) rather than being firmly anchored. It is thus called the "diffuse layer".
* [Interfacial](https://en.wikipedia.org/wiki/Interface_(chemistry)) DLs are most apparent in systems with a large surface area to volume ratio, such as a [colloid](https://en.wikipedia.org/wiki/Colloid) or porous bodies with particles or pores (respectively) on the scale of micrometres to nanometres. However, DLs are important to other phenomena, such as the [electrochemical](https://en.wikipedia.org/wiki/Electrochemical) behaviour of [electrodes](https://en.wikipedia.org/wiki/Electrode).
* DLs play a fundamental role in many everyday substances. For instance, homogenized milk exists only because fat droplets are covered with a DL that prevents their [coagulation](https://en.wikipedia.org/wiki/Coagulation_(milk)) into butter. DLs exist in practically all [heterogeneous](https://en.wikipedia.org/wiki/Heterogeneous) fluid-based systems, such as blood, paint, ink and ceramic and cement [slurry](https://en.wikipedia.org/wiki/Slurry).



Schematic of double layer in a liquid at contact with a negatively-charged solid. Depending on the nature of the solids, there may