Electrophoresis of dielectric colloids with hydrophobic surface

Somnath Bhattacharrya
Department of Mathematics, IIT Kharagpur, India

Theoretical and numerical analysis is made for electrophoresis of charged colloids for a generalized situation in which the particle is considered to be polarizable and the surface exhibits hydrophobicity. The dielectric polarization of the particle creates a nonlinear dependence of the electrophoretic velocity on the applied electric field, and the surface hydrophobicity amplifies the fluid convection in the Debye layer. Thus, a linear analysis is no longer applicable for this situation. The present analysis is based on the numerical solution of the nonlinear electrokinetic equations based on the Navier-Stokes-Nernst-Planck-Poisson equations coupled with the Laplace equation for the electric field within the dielectric particle. The hydrophobicity of the particle may influence its electric polarization by enhancing the convective transport of ions. The nonlinear effects, such as double-layer polarization and relaxation, are also influenced by the hydrophobicity of the particle surface. The electrophoresis of a soft particle with pH-regulated polyelectrolyte layer will be introduced.