Electrophoresis of Particles with Navier Velocity Slip

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In the present investigation, it is found that the electrophoretic mobility of hydrophobic particles is affected not only by the zeta potential but also by the velocity slip at the particle surface. From a physicochemical viewpoint, zeta potential represents the surface charge properties and the slip coefficient indicates the hydrophobicity of the particle surface. Thus, it is necessary to separate the contribution of zeta potential from that of slip coefficient to the particle mobility, since zeta potential can be changed by varying the bulk ionic concentration while the slip coefficient can be modified by adjusting surfactant concentration. In the present investigation, a method is devised that allows a simultaneous estimation of zeta potential and slip coefficient of micro and nano particles using measurements of electrophoretic mobility at various bulk ionic concentrations. Employing a nonlinear curve-fitting technique and an analytic solution of electrophoresis for a particle with velocity slip, the present technique predicts both zeta potential and slip coefficient simultaneously with reasonable accuracy using the measured values of electrophoretic mobility at various bulk ionic concentrations.