

Electrophoresis of fluid and crystalline ordered colloidal suspensions

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We have studied the flow behaviour of fluid and crystalline ordered aqueous suspensions of charged particles at low salt concentrations which were subjected to homogeneous electric fields. Both microscopy and a super-heterodyne reference beam depolarised Laser Doppler Velocimetry were employed. In the fluid state the theoretically expected parabolic flow profile was observed and electrophoretic mobilities were extracted from the integral flow measurements at mid cell height. Spatially resolved measurements were performed for crystalline suspensions which showed a rich flow scenario in dependence on particle concentration and field strength. A protocol to determine the true mobility in the presence of non-parabolic flow profiles (e.g. partial plug-flow or shear banding) was developed. The mobility is observed to coincide with expectations based on the standard electrokinetic model and a numerically determined effective renormalized charge only in the crystalline state. For fluid order or isolated spheres significant deviations towards lower values are observed.