PARTICLE TRACKING ANALYSIS FOR THE MEASUREMENT OF ZETA-POTENTIAL AND PARTICLE SIZE

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1. INTRODUCTION
Particle tracking analysis (PTA) is an optical video microscopy technique that visualises the motion of submicron particles. This is achieved by illuminating a liquid suspension of particles with a laser and imaging the light scattered by the particles with a low magnification objective as a function of time. Software then ‘tracks’ the motion of individual particles in 2 dimensions, and analysis of this spatio-temporal information can be used to determine associated properties at the single-particle level, even for particles with dimensions well below the wavelength of the light source.

PTA is increasingly finding applications in particle sizing, where the track length of a particle undergoing Brownian motion is used to determine its diffusion coefficient which in turn is related to its hydrodynamic diameter. Studying the particle motion in response to an applied electric field allows the measurement of electrophoretic mobility and associated quantities such as zeta potential (\(\zeta\)-potential), providing information about properties such as surface charge density that influence the interaction of particles with their environment and the stability of particle suspensions.

PTA is attractive because it is a single-particle technique, provides visualisation of a sample and allows in situ studies of dynamic processes. In this work, size and \(\zeta\)-potential measurements made with PTA are compared to those obtained using the more established methods of dynamic light scattering (DLS) and laser doppler velocimetry (LDV).

2. PARTICLE TRACKING vs DYNAMIC LIGHT SCATTERING
The samples investigated in this study included two polystyrene latex suspensions (nominal diameters 100 nm and 350 nm) with negative \(\zeta\)-potentials, and a certified electrophoretic mobility standard, goethite-based, with an electrophoretic mobility of 2.53 \(\mu\)m·cm/V·s (corresponding to a positive \(\zeta\)-potential of 35.7 mV). Since the PTA and DLS instruments require different particle concentrations, samples with a range of different concentrations were prepared, and \(\zeta\)-potential and particle size distribution were measured in both instruments.

The results for all samples agreed well, however the size measured by PTA was generally larger than that measured by DLS. The comparison also showed that PTA can be used successfully for measurements of \(\zeta\)-potential of very dilute particle suspensions.