Exploring Colloidal Kinetics Using Dynamic Light Scattering

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Colloidal systems undergo time-dependent transformations such as aggregation, dissociation, gelation, and phase separation, where mechanistic insight depends on resolving transient states on experimentally relevant timescales. Dynamic Light Scattering (DLS) is widely used for particle sizing, yet conventional single-angle, or sequential goniometer-based measurements can be difficult to interpret during non-equilibrium processes, particularly in the presence of intermittent contaminants, rare scattering bursts, or evolving heterogeneity that distorts correlation functions and compromises reproducibility [1-2].
This presentation introduces a real-time methodology for probing colloidal kinetics using DLScat (Swabian Instruments). The approach combines high-temporal-resolution correlation analysis with improved robustness against non-ideal measurement conditions. Simultaneous multi-angle detection (up to five scattering angles) provides internal consistency checks during time-resolved experiments and supports discrimination between genuine kinetic evolution and angle-dependent artifacts. In parallel, an adaptive spike-filtering algorithm suppresses transient scattering events in real time, reducing their influence on the estimated correlation function and enabling continuous tracking of dynamic changes.
Representative applications will be discussed, including salt-induced aggregation, protein self-association, and incipient gelation, in which the technique captures the evolution of characteristic size scales and polydispersity over time. Overall, our approach extends DLS from a predominantly steady-state sizing tool toward a more reliable platform for quantitative, time-resolved characterization of colloidal kinetics.

Keywords:
Kinetics, multi-angle dynamic light scattering, time-resolved measurements

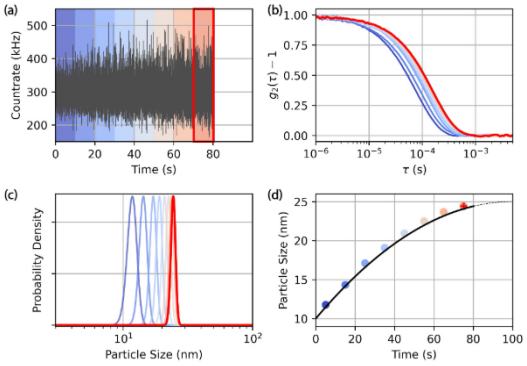

Figure 1. Simulated real-time kinetics from a 100 s DLS measurement, segmented into 10 s intervals and reprocessed. Results are shown in four panels: (a) count rate, (b) intensity autocorrelation function, (c) size distribution, and (d) particle size as a function of time.

References:

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