Stimulus-Driven Dynamics and Microrheology across the Soft-to-Hard Continuum of Responsive Colloids

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Responsive colloids are well-suited to investigate how external stimuli alter particle interactions, dynamics, and mechanical response. Here, we study two model systems spanning the soft-to-hard continuum: thermoresponsive poly(N-isopropylacrylamide) (PNIPAM) microgels with different crosslinking degrees, and electrorheological suspensions of anisotropic silica nanorods under applied electric fields. Using diffusing-wave spectroscopy (DWS), we track the stimulus-driven evolution of these systems through the intensity correlation function, the mean-squared displacement, and the viscoelastic moduli obtained by microrheology. For PNIPAM microgels, we examine how temperature and particle softness influence relaxation dynamics and mechanical response over a broad concentration range. For nanorod suspensions, we address how electric-field-induced organization affects particle dynamics and viscoelastic behavior. By comparing these two classes of responsive colloids within a common experimental framework, we aim to identify general links between the applied stimulus, particle-scale dynamics, and the resulting rheological response.

Keywords:
Responsive Colloids, Microgels, Microrheology, Light Scattering

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