THE THEORETICAL FOUNDATION OF SPIN-ECHO SMALL-ANGLE NEUTRON SCATTERING (SESANS) APPLIED IN COLLOIDAL SYSTEM

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ABSTRACT

The recently devenloped spin-echo small-angle neutron scattering (SESANS) is an elastic scattering technique to provide structures with the SESANS correlation function in real space. It probes the length scale from tens of nm to several microns. Because of the specific projection method implemented in SESANS instrument, it has the great advantage to overcome the limitations of multiple scattering and the incoherent background. The framework to apply SESANS for the concentrated spherical hard colloid system with different interaction potentials is developed, and a general discussion of the features in SESANS correlation functions for different model systems is presented. The prospect to apply SESANS for colloidal particles with nonuniform intraparticle mass distribution is then explored. As examples, the core-shell structure and the soft colloid with a Gaussian model are investigated in the concentrated case. Contrast variation, as a commonly used method in conventional small angle neutron scattering (SANS), is also combined with SESANS and it is demonstrated that contrast variation SESANS is sensitive in detecting both intra- and inter-colloidal heterogeneity.