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Investigation of Nanoscale Structure Using Spin-Echo Small-Angle Neutron Scattering (SESANS) XIN LI, ROGER PYNN, ADAM WASHINGTON, Indiana University, WEI-REN CHEN, KUNLUN HONG, GREGORY SMITH, Oak Ridge National Laboratory, YUN LIU, National Institute of Standards and Technology — Spin-Echo Small-Angle Neutron Scattering (SESANS) is a new technique for probing structural correlations in real space over distances ranging from ∼20 nm to several microns. The measured SESANS correlation function is a projection of the normal Patterson correlation function on to a particular spatial direction. A framework to theoretically calculate this correlation function is laid out, followed by a general discussion of the features of the SESANS correlation function for colloidal systems with different interaction potentials. Our calculations for a system of monodisperse spherical particles, show that SESANS is much more sensitive to the intercolloid potential than conventional Small Angle Neutron Scattering. We have used SESANS to study the correlations between 300-nm-diameter surfactant-stablized poly(methyl methacrylate) (PMMA) spheres suspended in a good solvent, with and without an added polymeric depletant. Below a PMMA volume fraction of ∼30% we find good agreement between the experimental data and theoretical prediction based on the Percus-Yevick approximation. With a small amount of polymer added to the suspension (less than 0.2% by weight of 110 kD polymer), the short-range correlations between PMMA spheres are enhanced because of the presence of polymer depletant. The magnitude of the change is roughly as expected on the basis of calculations of a mixture of spherical particles of different sizes.

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