Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Nanorod Mobility within Entangled Wormlike Micelle Solutions
JONGHUN LEE, Argonne Natl Lab, ALINE GREIN-IANKOVSKI, Federal University of Parana, SURESH NARAYANAN, Argonne Natl Lab, ROBERT LEHENY, Johns Hopkins University — In the semi-dilute regime, wormlike micelles form an isotropic entangled microstructure that is similar to that of an entangled polymer solution with a nanometer-scale entanglement mesh size. We report a combined x-ray photon correlation spectroscopy and rheology study to investigate the translational dynamics of gold nanorods in entangled wormlike micelles formed by the surfactant cetylpyridinium chloride (CPyCl) and the counterion sodium salicylate (NaSal). The CPyCl concentration is varied to tune the entanglement mesh size over a range that spans from the nanorod diameter to the nanorod length. On short time scales the nanorods are localized on a length scale of the entanglement mesh as long as the mesh size is smaller than the nanorod length. On longer time scales, the nanorods undergo free diffusion. At the highest CPyCl concentrations, the nanorod diffusivity approaches the value expected based on the macroscopic viscosity of the solutions, but it increases with decreasing CPyCl concentration more rapidly than expected from the macroscopic viscosity. A recent model for nanoparticle "hopping" diffusion in entangled polymer solutions accounts quantitatively for this enhanced diffusivity [Macromolecules 2015, 48, 847].

Jonghun Lee
Argonne Natl Lab

Date submitted: 11 Nov 2016 Electronic form version 1.4