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**Self assembly of silica nanoparticles in a surfactant mesophase** K. SHARMA, Ph.D. student, K. GURUSWAMY, Scientist, O. MONDAIN-MONVAL, Professor, I. LY — We examine the organization of silica particles in a hexagonal mesophase of a non-ionic surfactant, $C_{12}E_9$ in water. The mesophase has a characteristic length scale (cylinder center-to-center distance, a $\sim$ 5.7 nm). We vary the size of the silica particles from $\sim$ 2 nm ($<$ a) to $\sim$500 nm ($>>$ a), to examine the effect of particle size, and use a combination of SAXS, freeze fracture TEM and optical microscopy to characterize our materials. We show that particles $<$ a behave like a solvent and template the mesophase. Particles with a size $\sim$ a are partitioned into a dispersed phase and into strand-like aggregates. Particles $>$ a phase separate from the mesophase and form strand-like aggregates that organize into a network. The formation of this network is reversible and heating into the high temperature isotropic phase leads to dispersion of the particles. Unusually an *increase* in hexagonal-isotropic transition temperature is seen for the mesophase-particle composites. We show that the network forms by expulsion of the particles from growing hexagonal phase domains – as these domains grow, the particles are concentrated in the isotropic regions until they jam to form the network. We show that we are able to tune the mesh size of the particulate networks by changing the cooling rate.

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