550c Synthesis of Anisotropic Particles by Seeded Emulsion Polymerization

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Anisotropic colloid particles are encountered in numerous commercial and industrial applications, including coatings, adhesives, impact modifiers, medical diagnostics, and photonic crystals. Here we are interested in controlling the anisotropy of anisotropic nanoparticles with the goal of building novel microstructures to enhance macroscopic properties. Previous seeded emulsion polymerization techniques employed by Sheu and El-Aasser resulted in anisotropic particles between 5-10μm of a wide range of morphologies [1]. Building off of this seeded emulsion polymerization synthesis, anisotropic polystyrene nanoparticles are prepared. We have found that anisotropy is enhanced though a surface modification where the surface is coated with a thin hydrophilic polymer layer prior to swelling particles with styrene. After initiating polymerization by addition of an oil soluble initiator, "bumps" are formed off of the parent spheres. Systematically changing experimental parameters of cross link density, swelling ratio and type and degree of hydrophilic coating applied to the spheres, results in nanoparticles of varying degrees of asymmetry. The particles are characterized by scanning electron microscopy, dynamic light scattering, and ultra small angle X-ray scattering. This method of creating anisotropic particles has advantages of ease of scale up and uniformity of the final product. Reference: 1. H.R. Sheu, M.S. El-Aasser, and J.W. Vandherhoff, "Phase Separation in Polystyrene Latex Interpenetrating Polymer Networks," Journal of Polymer Science: Part A: Polymer Chemistry, 28, 629-651 (1990).