

Recent Developments in Polymer Nanoprecipitation by Solvent Shifting

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Abstract

Nanoparticles of polymethylmethacrylate (PMMA) have been produced through the solvent shifting process (also called “Ouzo” process) in which water (Non Solvent) was added to a solution of PMMA in acetone (Solvent) or tetrahydrofuran (THF, solvent). At low concentrations of PMMA in the initial solution, and for large additions of water, the process yielded solid PMMA nanoparticles with a narrow distribution of particle sizes. The mean particle diameter varied linearly with the initial PMMA concentration in the solvent, in agreement with the predictions from the Smoluchowski equation for an aggregation process that had definite start and stop times. At higher PMMA concentrations, the mixing process yielded large drops containing both PMMA and trapped solvent, which coexisted with solid PMMA nanoparticles. The boundaries that separated the “Ouzo” region of compositions (solid PMMA nanoparticles only), from the “Non-Ouzo” region (solid nanoparticles and large drops) have been determined. It is proposed that this boundary is related to the overlap concentration of PMMA macromolecules in the initial solution.