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Particle Deposition of Silica and Polystyrene during Drop Evaporation

Nicole A. Szumigalski, Michael T. Harris, Lihui Wang
Davidson School of Chemical Engineering, Purdue University

ABSTRACT

In various industries, such as creating pigments, ceramics, emulsifiers, and catalysis, having silica particles that have a small size distribution, or are monodisperse, are important. In these products, particles with higher monodispersity lead to higher quality products. The problem with forming silica particles of a certain size is determining how the reagents and the alcohol solvent affect the particle size and size distribution. Concentrations of ammonia and water were varied, as well as the type of alcohol solvent. Analysis on the particle size and distribution was conducted through dynamic light scattering. After analysis, silica particles were centrifuged and then suspended in de-ionized water. As the concentration of ammonia increased, and as the alcohol solvent had a larger ethanol to methanol ratio, the particles' size increased. The effect of the water concentration on the silica particles showed varied results. The silica particles synthesized were then used for drop-drying experiments. In the pharmaceutical industry, an efficient method for creating oral dosage strips and tablets is through drop-printing of drug suspensions. Drop-on-demand printing allows for controllable deposition of active pharmaceutical ingredients. For drop-printing, the problem is to find how to print the active ingredient evenly distributed on the substrate. Polystyrene particles were added to a suspension of the silica nanoparticles and drop-drying experiments were conducted. For the drop-drying experiments, the smaller silica particles deposited closer to the contact line than the larger polystyrene particles.

KEYWORDS

Silica, Nano-Particle Formation, Particle Deposition, Drop Evaporation