MAR09-2008-000249

Abstract for an Invited Paper
for the MAR09 Meeting of
the American Physical Society

Engineered Colloids Having Particles of Controlled Size, Shape, and Chemistry[1]

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This lecture will focus on opportunities for complex particles made using a novel "top-down" fabrication method called PRINT (Particle Replication In Non-wetting Templates). PRINT enables the production of monodisperse, shape-specific nano and micro-particles from an extensive range of organic and inorganic liquid precursors. The assembly of colloidal particles has long been a rich and continuously growing area of materials science, with great potential for a broad range of applications including electronics, control systems, optics and biotechnology. Within this field, the bulk of research has been devoted to studying the assembly of isotropic spherical particles. In spite of this, there has been a growing interest in studying the assembly of anisotropic particles due to the more complex and useful structures that these particles can potentially assemble into. There are few reports on the assembly of anisotropic particles, in part because of the lack of effective fabrication processes for the preparation of these particles with the monodispersity, control and range of compositions required for in-depth study. Herein we will discuss the use of PRINT to fabricate monodisperse, nanometer- and micron-sized particles of varying size, shape and composition. PRINT stands out because of the high degree of molding resolution, the broad range of chemistries that can be molded, and the ease with which reel-to-reel technology can be incorporated for scalability. Thus, it is ideally suited to the synthesis of unique, highly anisotropic particles in a wide range of compositions. Herein we discuss the use of dielectrophoresis to study the assembly of highly anisotropic polymer particles: rods, discs, hexnuts and boomerangs, fabricated with the PRINT process. In addition, the discussion will focus on the details and opportunities for loading shape controlled particles with magnetite and their manipulation when dispersed in various liquid media.

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