Dendrimer-mediated Synthesis of Magnetic Nanoparticles: CoPt

H. Wan, G. Thompson, M. Shamssouzoha, and S. Street

The MINT Center, The University of Alabama

Motivation

• Nanoparticles are becoming increasingly important in many areas, including catalysis, biomedical applications, and information storage. In particular, magnetic nanoparticles are attractive for data storage devices in various media. Nanoparticle size and shape will influence magnetic properties; therefore, controlling particle growth is extremely important.
• In this study, we focus our attention on synthesizing CoPt nanoparticles in aqueous solutions using poly(amidoamine) (PAMAM) dendrimers and either UV irradiation or chemical reducing agent to reduce precursor metal ions to the zerovalent alloy.

Dendrimers as Functional Components

Starburst PAMAM Dendrimers

Dendrimers are 3-D, highly branched, macromolecules with a core/repeat unit/terminal shell structure. Generally classified by generation, e.g., G4: -OH terminated 64 endgroups MW ~ 14000 4.5 nm (dia. in soln.)

Chemical Reduced CoPt/G4 Nanoparticles

• Particles are monodisperse and have an average size of 3±0.5 nm
• The diffraction patterns only show fcc phase

Conclusions

• We have developed new methods for preparing bimetallic nanoparticle CoPt at room temperature, using dendrimers as synthetic templates and cluster stabilizers.
• The chemical reduction method only synthesizes disordered fcc CoPt nanoparticles. The nanoparticles are monodisperse and the size of the nanoparticles can be modified based on dendrimer size.
• Diffraction patterns obtained via TEM on selected areas show photoreduced CoPt particles have L10 crystal structure. However, the whole product maybe is a mixture phase of disordered fcc, ordered fcc and fct, because the particles do not exhibit the coercivity associated with single-domain particles of their apparent size.