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Dendrimer-Encapsulated Nanoparticles: Synthesis, Characterization, and Electrocatalysis

One approach for designing improved nanoparticle catalysts involves the use of first-principles calculations, such as density functional theory (DFT), to predict the structural properties of efficient, new materials. As these types of calculations have begun to emerge, however, it has become increasingly clear that there are few or no experimental models available to test them. Dendrimer-encapsulated nanoparticles (DENs) provide an opportunity to meet this need, because their size, composition, and structure can be controlled and because they have a size that is compatible with DFT calculations (< 200 atoms). DENs are synthesized by complexing metal ions with interior tertiary amines of poly(amido amine) (PAMAM) dendrimers, followed by chemical reduction. By controlling the metal-ion-to-dendrimer ratio, the size of DENs can be controlled. In addition, bimetallic DENs have been prepared by complexing and chemically reducing different metals either simultaneously, which usually yields alloys, or sequentially, which might lead to core/shell structures. This chemical reduction method has proven effective, but it can be difficult to precisely control DEN size and structure. In contrast, a new approach for synthesizing core-shell DENs, which is based on the electrochemical method of underpotential deposition (UPD), provides a means for exerting a much higher level of control over the shell structure. The relationship between DEN structure and electrocatalytic measurements will be discussed.

Meloche Analytical Seminar

Thursday, October 10th at 12:15 pm in 1315 Chemistry