Chemistry Colloquium

Wednesday, September 29, 12 pm

Hutchison Hall, Lander Auditorium

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"*Developing Synthetic Tools for Inexpensive, Efficient Energy Production and Storage*"

Abstract: We are interested in developing new synthetic methods for nanoscale materials with applications in energy conversion and storage. For this talk, I will focus first on using photovoltaic devices to produce energy. Second, I'll talk about developing new architectures for rechargeable Li-ion batteries for storing that energy.

Colloidal inorganic nanocrystals offer many advantages for use in photovoltaic devices: controllable synthesis, processability, and tunable band gap energies. Ideal materials for photovoltaics would contain earth abundant, nontoxic elements and would possess optimal band gaps for solar energy absorption. Copper and iron chalcogenides exhibit these properties. Computational methods for predicting ideal structures are becoming quite powerful, but the development of synthetic methods to access those structures is still a significant challenge. I'll discuss the solution phase synthesis and characterization of families of ternary iron and copper chalcogenide nanoparticles, as well as the first steps of developing a more detailed understanding of the transformations that occur in solution between organic and inorganic species critical for controlling the composition, structure, and morphology of these particles.

One of the challenges in producing energy using devices such as photvoltaics is that that energy needs to be stored efficiently. One of the current best ways to do that is to use batteries. There are two main limitations to the rate of charging Li-ion batteries: slow diffusion of Li+ into the electrodes and slow diffusion between them. The synthesis of high surface area electrodes has been shown to dramatically enhance performance because reducing the particle size of the electrode material reduces the distance the Li+ ions have to diffuse. The problem of decreasing the Li+ diffusion length between electrodes has not yet been solved. We are working to incorporate high surface area structures of a novel anode material into a new battery architecture wherein the current collector is conformally coated with an electrolyte made by electrochemical deposition, then surrounded by the cathode electrode. The significant advantage is that the diffusion length for Li+ between the cathode and anode will be dramatically reduced, which should lead to much faster charging rates.

Website: https://events.rochester.edu/event/chemistry_physical_colloquium_prieto

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