UCLA College | Physical Sciences Chemistry & Biochemistry

Chem 218: Student Exit Seminar

Enabling High Capacity Anodes and Cathodes for Li-Ion Batteries

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Rechargeable battery technologies are important for a broad range of technology, and for many applications total battery capacity is the limiting factor. In this talk, we examine new anode and cathode materials that have the potential to increase the energy density of lithium ion batteries. For anodes, we focus on alloy anodes. Compared to their graphite counterpart, alloy anodes accommodate much more lithium per gram of material, leading to very high capacities. However, the large lithium volume results in detrimental volume expansion and contraction during cycling. Here, we describe how nanoscale architecture can help stabilizing these materials, focusing on mesoporous SbSn and Sb, and the use of X-ray microscopy to image structural change during cycling. The second part of the talk focuses on cathode materials. Common cathodes today are limited to ~200 mAh/g capacities, based on oxidation and reduction (Redox) at transition metal centers in an oxide or phosphate lattice. By having the anions participate in Redox, the capacity of cathodes can increase. Here, we discuss work on new electrodes that utilize icosahedral boron clusters as anionic, electrochemically-active building blocks. We also explore the reactivity of Li_2FeS_2, a system that shows both Fe and S Redox. By studying high energy density materials in lithium ion batteries, we hope to develop tools to stabilize cycling and broaden the scope of materials used as electrodes.

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12:00 p.m.
Via Zoom

For questions, please contact: jzabala@chem.ucla.edu