UCLA College | Physical Sciences Chemistry & Biochemistry

Chem 218

"Structure and Surfaces at the Nanoscale"

By Prof. Vanessa Wood

Department of Information Technology and Electrical Engineering

ETH Zürich

Liquid-phase and wet-processing techniques offer tremendous opportunities for low-cost manufacturing and enable the concept of large-scale nanotechnology. Today, these approaches have facilitated the massive upscaling of lithium ion battery technology and promise to play a future role in a wide variety of electronic, photonic, and electrochemical systems. Materials and devices made from these approaches often exhibit hierarchical structures and have complex interfaces that are key to their performance. In this talk, I will describe the importance of understanding structure-performance relationships to achieve the full potential of solution processed systems.

To characterize structure and structural dynamics in these complex, multiscale materials, we leverage a wide variety of techniques including electron microscopies, x-ray imaging, diffraction, and scattering, neutron scattering and imaging, and muon spectroscopy. Combining information from characterization with simulation and experiment, we use our findings to understand the origins of performance limitations and develop design guidelines to systematically improve material and devices.

My talk will present several examples, including the role of nanocrystal surfaces in determining their emission linewidths, carrier cooling, and charge transport, and the role of nanoscale structure and surface chemistry on electrolyte infilling in lithium ion batteries and lithium transport. I will address the experimental and computational challenges associated with studying these systems and emphasize ways machine learning techniques and systematic leveraging of size control the nanoscale can be used to overcome these challenges.

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