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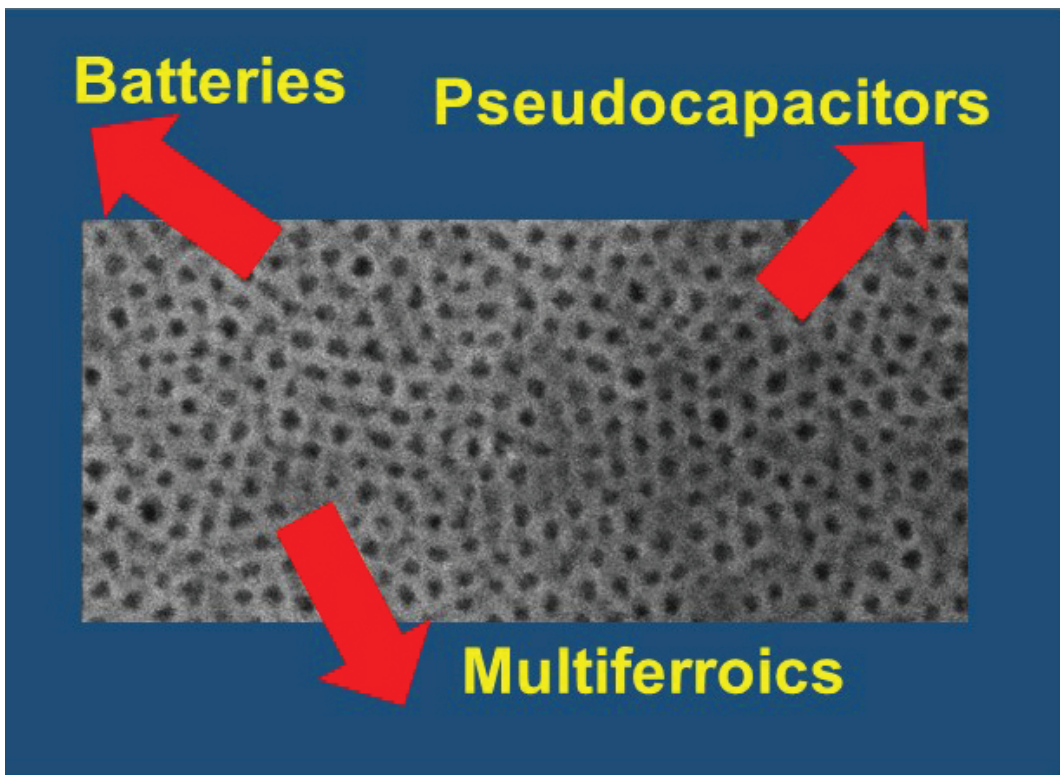
Sarah H. Tolbert

New Technology by Combining Nanoporous Materials with Synchrotron Radiation: From Next-Generation Batteries to New Multiferroics



This talk examines ways to use nanoporous materials to address complex materials problems, focusing on how nanoscale porosity can modify the structure and mechanical properties of materials. In electrochemical energy storage, nanoscale porosity produces a desirable combination of electrical connectivity, electrolyte access to the interior of the material, and very short solid-state diffusion lengths for lithium ions, all of which facilitate fast charging. More importantly, using operando diffraction, many nanoscale materials show suppression of the intercalation-induced phase transition that can cause kinetic limitations in bulk materials. Porous architectures can also be used to increase stability in high-capacity, large-volume-change alloy-type anode materials. Here, transmission x-ray microscopy (TXM) is used to directly image strain related changes in the pore structure itself upon cycling. Finally, in a very different system–multiferroic composites–porosity is used to simultaneously facilitate mechanical coupling between ferromagnetic and ferroelectric components of the materials and to tune mechanical stiffness.

Sarah H. Tolbert is a professor in the Departments of Chemistry and Biochemistry and Materials Science and Engineering at UCLA. Her research focuses on controlling nanometer-scale architecture in solution-processed nanomaterials to generate unique optical, electronic, magnetic, structural, and electrochemical properties. She has published over 180 scholarly research articles and has 20 patents focusing on electrochemical energy storage (including both pseudocapacitors and batteries), organic electronics, nanomagnetics, nanoscale control of thermal conductivity, and new ultra-hard materials. She also leads a program aimed at bringing nano-concepts to schools throughout the greater Los Angeles area. Professor Tolbert is the recipient of a number of awards including Fellow of the Royal Society of Chemistry; the UCLA Diversity, Equity, and Inclusion Award; a NSF Special Creativity Award; and the American Chemical Society R.A. Glen Award. She directs the DOE Energy Frontier Research Center on Synthetic Control Across Length-scales for Advancing Rechargeables (SCALAR).

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