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Real-Time probing of nanophase evolution in solutions

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Colloidal nanoparticle synthesis and transformation in solution phase represents a cost-effective and scalable strategy for mass production of functional materials. Availability of nanomaterials with tailored properties is the critical foundation for implanting nanoscale science and engineering in a variety of areas, such as catalysis, energy conversion/storage, biological imaging, medical therapy, etc. However, the current scenario is that the developed recipes are not robust for synthesizing high-quality nanoparticles due to the poor understanding of the complex nucleation and growth processes involved in nanoparticle synthesis. In this presentation, a couple of in-situ synchrotron x-ray techniques including time-resolved high-energy x-ray diffractions (TRHEXRDs) and transmission x-ray microscopy (TXM) will be introduced to show their capability in real-time probing of the chemical and physical processes associated with the nanophase evolution in solution-phase reactions. By taking the advantages of strong penetration of hard x-rays in liquid media and weak interaction with reactants, TRHEXRDs and TXM have been successfully used to study the synthesis of colloidal silver nanocubes and chemical transformation of silver nanowires into nanotubes, respectively. The real-time observations reveal the kinetic processes that are difficult to obtain with conventional techniques. The new understanding on the nanophase evolution may help us to design and establish more robust recipes for the synthesis of colloidal nanoparticles with more precisely tailored properties.

Biography

Yugang Sun received B. S. and Ph. D degrees in chemistry from the University of Science and Technology of China (USTC) in 1996 and 2001, respectively. He is currently a scientist at the Center for Nanoscale Materials of Argonne National Laboratory. Dr. Sun is the 2007 recipient for The Presidential Early Career Awards for Scientists and Engineers (PECASE) and DOE's Office of Science Early Career Scientist and Engineer Award. His current research interests focus on the synthesis of a wide range of nanostructures, including metal nanoparticles with tailored properties, the development of in-situ synchrotron x-ray techniques for real-time probing of nanoparticle growth, and the application of these nanomaterials in energy storage, photocatalysis and sensing.

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