

Carnegie Mellon

Materials Science and Engineering Seminar Series

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“Shape-Controlled Synthesis of Noble-Metal Nanocrystals”

Friday, March 18, 2011
10:30 AM Seminar in Scaife Hall 125

Control of nanocrystal shape may initially seem like a scientific curiosity, but its goal goes far beyond aesthetic appeal. For metal nanocrystals, shape not only determines their intrinsic chemical, plasmonic, and catalytic properties but also their relevance for electronic, optical, and sensing applications. Part of our research over the last decade has focused on shape-controlled synthesis of noble-metal nanocrystals. While the synthetic methodology mainly involves solution-phase redox chemistry, we have been working diligently to understand the complex physics behind the simple chemistry – that is, the nucleation and growth mechanism leading to the formation of nanocrystals with specific shapes. Polyol synthesis of silver nanocrystals provides a good example to illustrate this concept. We discovered that the shape of silver nanocrystals are dictated by both the crystallinity and shape of nanocrystallite seeds, which are, in turn, controlled by factors such as reduction rate, oxidative etching, and surface capping. The same mechanism also works for other systems including gold, palladium, and platinum. The success of these syntheses has enabled us to tailor the electronic, plasmonic, and catalytic properties of noble-metal nanocrystals for a range of applications.

Younan Xia is the James M. McKelvey Professor for Advanced Materials in the Department of Biomedical Engineering at Washington University in St. Louis. His research interests include development of new methodologies for controlling the synthesis of nanomaterials and exploration of their applications in biomedical and energy research. He received a B.S. degree in chemical physics from the University of Science and Technology of China (USTC) in 1987 and worked as a graduate student on inorganic nonlinear optical crystals in the Chinese Academy of Sciences. He came to the States in 1991, received a M.S. degree in inorganic chemistry from the University of Pennsylvania (with the late Professor Alan G. MacDiarmid) in 1993, and a Ph.D. degree in physical chemistry from Harvard University (with Professor George M. Whitesides) in 1996. He continued his training at Harvard as a postdoctoral fellow and then joined the University of Washington (UW) in Seattle as an Assistant Professor of Chemistry in 1997, and was promoted to Professor in 2004. His group relocated to Washington University in St. Louis (WUSTL) in the summer of 2007. Dr. Xia has received a number of awards, including a Materials Research Society (MRS) Fellow (2009); an NIH Director's Pioneer Award (2006); a Leo Hendrik Baekeland Award from the North Jersey Section of ACS (2005); a Camille Dreyfus Teacher Scholar (2002); a David and Lucile Packard Fellow in Science and Engineering (2000); an NSF CAREER Award (2000); an Alfred P. Sloan Research Fellow (2000); an ACS Victor K. LaMer Award (1999); and a Camille and Henry Dreyfus New Faculty Award (1997). He has co-authored more than 430 publications in peer-reviewed journals and has edited a number of special issues on nanostructured materials. He is an Associate Editor of *Nano Letters* (since 2002), and serves on the international advisory boards of *Angewandte Chemie International Edition*, *Accounts of Chemical Research*, *Advanced Functional Materials*, *Nano Today*, *Nano Research*, and many others.