Stevens Institute of Technology

Nanotechnology Graduate Program

# *Gold Nanostructures: Engineering their Plasmonic Properties for Biomedical Applications*

**Wednesday, September 6, 2006**
**Babbio Bldg, Room 104, Time 11am**

**Professor Younan Xia**
Department of Chemistry, University of Washington

Complex nanostructures with novel properties can often be prepared using some simple chemical reactions. For instance, galvanic replacement reaction between silver nanocubes and HAuCl4 in an aqueous solution transforms 30-200 nm silver nanocubes into gold nanoboxes and nanocages (nanoboxes with porous walls). By controlling the molar ratio of silver to $HAuCl_4$, the plasmon peaks of resultant nanostructures can be continuously tuned from the blue (400 nm) to the near infrared (1200 nm). These hollow gold nanostructures are characterized by extraordinarily large cross-sections for both absorption and scattering. Optical coherence tomography measurements indicate that the 35-nm nanocage has a scattering cross-section of ~$0.8 \times 10^{-15}$ $m^2$ and an absorption cross-section of ~$7.3 \times 10^{-15}$ $m^2$; both of them are more than five orders of magnitude larger than those of conventional organic dyes. Exposure of gold nanocages to a camera flash resulted in the instant melting and conversion of gold nanocages into spherical particles due to photothermal heating. Gold nanocages can be easily bioconjugated with antibodies to target any specific cancer cells. This novel class of hollow nanostructures is being developed as both a contrast agent for optical imaging in early-stage cancer detection, and as a therapeutic agent for photothermal cancer treatment.

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**Younan Xia** is a Professor of Chemistry at the University of Washington (UW) in Seattle. His research interests include development of new methodologies for shape-controlled synthesis of nanomaterials and fabrication of functional nanostructures and devices. 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 at the Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences. He came to the United States in 1991, received a M.S. degree in inorganic chemistry from the University of Pennsylvania (with 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 work at Harvard as a postdoctoral fellow with both Professors George M. Whitesides and Mara Prentiss. Dr. Xia joined the UW faculty as an Assistant Professor of Chemistry in 1997, and was promoted to the rank of Full Professor in 2004. He has received a number of awards, including the Leo Hendrik Baekeland Award from the NJ Section of ACS (2005), the Camille Dreyfus Teacher Scholar (2002); the David and Lucile Packard Fellow in Science and Engineering (2000); the National Science Foundation CAREER Award (2000); the Alfred P. Sloan Research Fellow (2000); the ACS Victor K. LaMer Award (1999); and the Camille and Henry Dreyfus New Faculty Award (1997). He has co-authored more than 200 publications in peer-reviewed journals and has edited a number of special issues and books on nanostructured materials and microfabrication techniques. He currently serves as an Associate Editor of the ACS journal Nano Letters, and sits on the advisory boards of Langmuir, Chemistry of Materials, Advanced Functional Materials, Nano Today, International Journal of Nanotechnology, and International Journal of Nanoscience.

**Light refreshments will be served prior to seminar**

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