CHEMICAL ENGINEERING

SEMINAR SERIES

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Metal Nanocrystals for Optical Nanospectroscopy

ABSTRACT: Current near-field spectroscopy techniques are limited by the ability to fabricate nanoscale probes that are robust, reproducible, and support high quality optical resonances. I will present our recent work on the synthesis and self-assembly of colloidal nanoparticles for the fabrication of resonant optical nanojunctions. Previously, we demonstrated that shaped colloidal nanoparticles can be organized into nanojunctions that possess intense "hot spots" due to electromagnetic field localization. When these nanoparticles are brought into contact with a metal substrate, they form a high quality optical cavity with a coupled resonance mode. Here, I will describe how colloidal nanoparticles can be assembled and used as scanning near-field optical probes for Raman nanospectroscopy. Nanoparticles are assembled onto commercially available silicon atomic force microscope cantilevers that can then be raster scanned across a surface during optical measurements. Nanoparticle size and shape can be used to modulate the optical response of the scanning probe. To the best of our knowledge, the nanoparticle probes demonstrated in our work exhibit the largest near-field enhancements reported for tip-enhanced Raman spectroscopy measurements under ambient conditions. The methods presented in our work have the potential to enable Raman nanospectroscopy as a powerful tool for chemical mapping of surfaces and nanomaterials.

RECEPTION 3:30 • LECTURE 4:00 – 5:00
PHYSICS ASTRONOMY BLDG. (PAA) A110

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BIO: Dr. Tao is currently an Associate Professor in the NanoEngineering Department at UC San Diego. She earned her A.B. in Chemistry and Physics from Harvard University in 2002 and her Ph.D. in Chemistry from UC Berkeley in 2007 where she conducted her dissertation research on colloidal synthesis and self-assembly. She was a UC President's Postdoctoral Fellow at UC Santa Barbara in the interdisciplinary program of Biomolecular Science & Engineering, where she studied the dynamic camouflage mechanisms of cephalopods. Her research interests lie in the discovery and development of new nanomaterials for plasmonics, where light is propagated, manipulated, and confined by nanocomponents that are smaller than the wavelength of light itself. She is the recipient of the 2008 International Union of Pure and Applied Chemistry Prize for Young Chemists, a 2013 RSC Emerging Investigator, a 2014 DARPA Young Faculty Award, and the 2015 Sloan Fellowship in Chemistry.