

CHEMICAL ENGINEERING

SEMINAR SERIES



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Plasmonic Nanostructures for SERS Biosensing and Optoelectronic Devices

ABSTRACT: Our research focuses on plasmonic nanostructures and semiconductor nanomaterials for the applications in chemical and biological sensors and optoelectronics devices. We utilize an integrated computational and experimental approach to design plasmonic nanostructures with novel properties, to understand material growth and processing mechanisms, and ultimately to make devices with superior performance. In this talk, I will give a brief overview on our recent research and highlight the work on the development of plasmonic nanostructures and surface chemistry for biosensing based on surface-enhanced Raman spectroscopy (SERS) as well as plasmonic electrodes for photovoltaic devices and UV photodetectors. I will discuss the challenges for SERS-based biosensing and our approaches to tackle the challenges by developing new SERS-active substrates and unique surface chemistry. Based on the understanding of physical origins that plasmon resonances generate, we developed novel quasi-3D plasmonic nanostructures arrays (Q3D-PNAs) with tunable strength and location of the strongest local electric fields (i.e., hot spots) and long-range SERS (LR-SERS) substrates with extended strong electric field, which allows the optimal detections of small and large analytes. We further functionalized the SERS-active substrate surfaces with probe/attraction molecules mixed with non-fouling molecules/polymers to enable sensitive, specific and dynamic detection of small molecules with weak Raman signals or cations that have no Raman signals. I will show the applications in rapid identification of pathogens, detection of sugars and drugs in complex media, and mapping of extracellular pH distribution of cancer and normal cells. Then I will briefly talk about our recent research on developing transparent plasmonic metal electrodes to replace ITO for organic bulk-heterojunction (BHJ) photovoltaic devices and UV photodetectors.

RECEPTION 3:30 • LECTURE 4:00 – 5:00
PHYSICS ASTRONOMY BLDG. (PAA) A118



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BIOGRAPHY: Qiuming Yu received her BS and MS degrees from the Department of Chemistry at Nanjing University in China. She earned her Ph.D. degree from the Department of Chemical Engineering at Cornell University in 1995. She was a postdoctoral fellow at the Microdevices Laboratory at the NASA Jet Propulsion Laboratory / California Institute of Technology. After spent three years as research assistant professor in the Department of Chemical Engineering at Kansas State University, she moved to the University of Washington (UW) in 2000, where she served as research associate in the Departments of Physics and Chemical Engineering, and lab manager of the Nanotech User Facility at the UW Center for Nanotechnology. Currently, she is a research associate professor at UW Chemical Engineering. Her research focuses on semiconductor nanomaterials and plasmonic nanostructures for photovoltaics and optoelectronics devices and chemical and biological sensors.