UCLA College | Physical Sciences Chemistry & Biochemistry

Chem 218: Student Exit Seminar

"Surface Functionalization, Patterning, and *in Situ* Growth of Gold Nanoparticles"

By Gail Vinnacombe-Willson
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Abstract: We develop straightforward bottom-up methods for rationally incorporating gold nanoparticles (AuNPs) onto oxide materials, onto polymers, and within microfluidic devices. Plasmonic AuNPs strongly interact with light due to the localized surface plasmon resonance (LSPR) phenomenon. The position and quality of the LSPR peaks depend on the AuNP crystal structure, diameter, geometry, and local dielectric environment, which are easily modulated *via* wet-chemical synthesis. Beyond high optical extinction, the LSPR effect can also lead to efficient light-to-heat conversion, hot carrier generation and intense localized electric fields. Moreover, when the individual particles are arranged into ordered arrays, even more complex optical responses or high-quality lattice plasmon resonances can be selected. Although wet-chemical synthesis yields individual plasmonic building blocks with superior qualities, precisely engineering plasmonic substrates from colloidal AuNPs is often challenging. The fabrication strategies developed herein have led to advances regarding *in situ* control over AuNP size and shape, pattern scalability, translatability, and versatility. We employ self-assembly and scalable subtractive soft lithography to produce arbitrary patterns from pre-synthesized AuNPs. In addition, we establish wet-chemical approaches for direct nucleation, growth, and shape-control that avoid time-consuming ligand exchange, self-assembly, and the need for costly equipment. Lastly, we explored *in situ* shape control to integrate thermoplasmonic gold nanostars within microfluidic platforms to target biomedical applications, including liquid biopsies. Overall, this work has potential impact for the fabrication of plasmonic biomedical devices, sensors, optoelectronics, and heterogeneous catalysts.

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12:00 p.m. I Young Hall 2033
& via Zoom

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