



DREXEL UNIVERSITY

Materials Science  
and Engineering  
*College of Engineering*

# Fall Seminar Series

## From the Beaker to an Engineering Platform: Polymer-Grafted Plasmonic & 2D Nano-Crystal Assemblies

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Senior Technologist, Emergent Materials Systems

Air Force Research Laboratory, WPAFB, OH

Wednesday, September 25, 2:00 p.m.

PISB 104

Efficient focusing of optical fields at the nanoscale holds immense potential for chemical sensing, photodetection, spectroscopy, and optical information processing. Transitioning this potential to applications however require the development of techniques to integrate these optoelectronic nanoparticle architectures into mechanically robust, spatially ordered arrays and films. Focusing on solution dispersions of gold nanorods (AuNR) and transition metal dichalcogenides (TMDs), we will discuss current efforts on fabrication, exfoliation, and functionalization of these building blocks with polymers. The tunability of the hard-soft architecture via the size and shape of the nanoparticle core and the areal density, composition, and molecular weight of the polymer grafts leads to chimeric characteristics; and thus opportunities to design inks and high inorganic fraction systems with ordered morphology while retaining the necessary processibility to create high-performance films and fibers. Post-processing, such as by laser reshaping, enables voxelated films or multi-notch optical filters from a single feedstock, further expanding potential. Further improvement our understanding of synthetic and assembly mechanisms is crucial to integrating such platform technologies into the manufacturing of compact sensors, optical modulators and specialty coatings.

Dr. Richard A. Vaia is the Senior Technologist for Emergent Materials Systems in the Air Force Research Laboratory (AFRL). His goal is to accelerate research and development at the convergence of Biotechnology, Nanotechnology, Quantum Science, and Infomatics to deliver critical component technologies to address National Defense Strategy, including warfighter-machine teaming, resilient sensing and communication, and futuristic warfighting concepts. Rich has published more than 250 articles on nanomaterials, with honors including the AF McLucas Award for Basic Research, ACS Doolittle Award, Air Force Outstanding Scientist, Air Force Office of Scientific Research Star Teams, and Fellow of the Materials Research Society, American Physical Society, American Chemical Society, and the Air Force Research Laboratory.