

Chemical Engineering Colloquium

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Goddard Hall, Room 227

12:00 PM – 1:00 PM

Nanoscale Interactions Between Functional Nanoparticles and Polymers

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The unique light-matter interactions of nanoparticles make them promising candidates for chemically specific and highly sensitive sensors. However, to realize this functionality, nanoparticles must remain stable and well-dispersed in complex environments. Here, we discuss two scientific vignettes identifying how nanoparticles interact with surrounding polymers to ensure their physicochemical stability and preserve optical functionality. First, we investigate how single-wall carbon nanotubes (SWCNTs) transport and disperse through polymer solutions as a model system for structurally heterogeneous fluids. We find that the anisotropic geometry of these nanotubes facilitates rapid transport even through highly entangled systems, demonstrating their potential as intracellular sensors. Second, we identify how surface-grafted polymers shift the optical spectra of gold nanospheres. We use this optical shift to extract quantitative measurements of the polymer grafting density in excellent agreement with established techniques, such as thermal gravimetric analysis. Additionally, our technique is non-destructive and requires $>1,000\times$ less sample, making it ideal for characterizing high-value nanomaterials. Future work will establish polymer grafted nanoparticles as optical sensors for emerging contaminants.

