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MSE 690 SEMINAR SERIES

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"Disordered Bicontinuous Composites"

Abstract: Bicontinuous materials, which consist of a continuous network of two interpenetrating phases, possess unique transport and mechanical properties that make them suitable for various applications including energy storage, catalysis, and separations. Disordered bicontinuous materials offer fault-tolerant structures that are amenable to scalable manufacturing. In this presentation, I will describe two types of disordered bicontinuous composites that are being developed in the Soft Materials Research and Technology (SMART) Laboratory at Penn: bicontinuous interfacially jammed emulsion gels (bijels) and polymer-infiltrated nanoparticle films (PINFs). Bijels are formed by arresting spinodal decomposition of two immiscible fluids, producing a distinct bicontinuous biphasic topology, with the interfaces between them covered by a jammed nanoparticle layer. The presence of this jammed nanoparticle layer at the fluid/fluid interface provides several features that make these bicontinuous materials unique for wave-matter interactions and separation applications. PINFs are another important class of bicontinuous composites formed by infiltrating polymers into disordered packings of nanoparticles. By heating or solvent annealing a bilayer of polymer and nanoparticle packing, the polymer is induced to infiltrate the particle packing. This presentation will describe different pathways by which these disordered bicontinuous composites can be manufacturedand the impact of various parameters on their structure and properties. Finally, examples of functional materials that are derived from these novel classes of composites will be discussed.

Biography:

Daeyeon Lee is the Russel Pearce and Elizabeth Crimian Heuer Professor of Chemical and Biomolecular Engineering at the University of Pennsylvania. He received his BS in Chemical Engineering at Seoul National University and PhD in Chemical Engineering at Massachusetts Institute of Technology. His research focuses on developing deep understanding of the interactions between soft materials near or at interfaces and extending the obtained knowledge to direct the assembly of macroscopic structures that have designed properties and functionality. He has won numerous awards including the 2010 Victor K. LaMer Award, NSF CAREER Award, 2013 3M Nontenured Faculty Award, 2013 AIChE NSEF Young Investigator Award, 2014 Unilever Award for Young Investigator in Colloid and Surface Science and 2017 Soft Matter Lectureship Award.

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