CHEMICAL & BIOMEDICAL ENGINEERING SEMINAR ANNOUNCEMENT

How Does Gelation Impact the Mechanical Properties of Polymer Networks? Insights from Polymer Mechanochemistry

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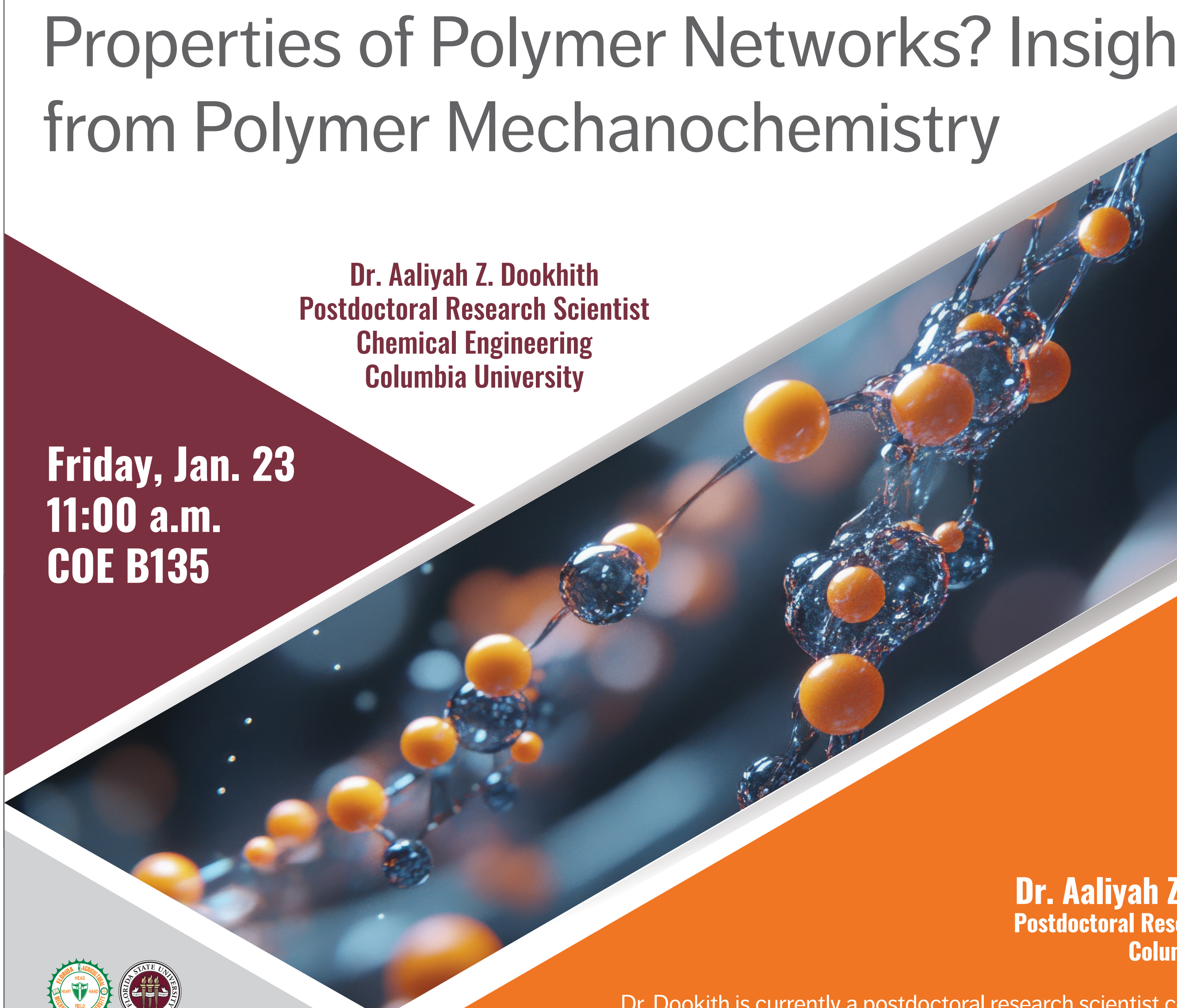

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COE B135

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Dr. Dookith is currently a postdoctoral research scientist co-advised with Dr. Sanat Kumar and Dr. Neil Dolinski in the Chemical Engineering department at Columbia University. Her postdoctoral work revolves around using dynamic chemistries to improve the mechanical recycling of polyolefins. She earned her B.Sc. in Chemical engineering at NYU Tandon School of Engineering where she worked with Dr. Miguel Modestino on the electro-organic synthesis of Nylon precursors. She then did her Ph.D. in Chemical Engineering at the University of Texas at Austin under the supervision of Dr. Gabriel E. Sanoja where she focused on leveraging living copolymerizations to tailor the fracture properties of polymer networks.

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Polymer networks that sustain large reversible deformations are widespread in engineering, biomedical, and electronic applications. However, their mechanical properties, particularly at large strains, remain challenging to design within their molecular architecture through conventional synthetic methods, as these offer limited control over the kinetics and thermodynamics of gelation and, in turn, the connectivity of polymer chains.

In this talk, I will discuss the use of chain transfer agents and catalysts as a tool to control the concentration of chain ends during gelation, the percolation threshold, the static heterogeneities, and the small- and large-strain mechanical properties of polymer networks. I will consider three (3) networks with similar densities of elastically active chains and evaluate their architecture and mechanical properties through optical microscopy, tensile testing, and mechanochemistry. I will show that delayed percolation results in nucleation of static heterogeneities near the gel point, lower chain extensibilities and delocalized stresses ahead of the crack front. Finally, I will provide rationale for controlling gelation to design advanced polymer networks for emerging and more stringent applications.