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Department of Chemical and Biomolecular Engineering

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Beyond The Tailpipe: From The Science of Soot Formation to The Engineering of Carbon Nanomaterials

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Abstract: The remarkable advances in our understanding of soot formation have been instrumental in reducing particulate matter emissions from cars, airplanes, and power plants. Beyond its role as a pollutant, soot, or carbon black, has a rich industrial history, serving as a critical component in everything from tires to printer pigments. As a quintessential example of gas-to-particle synthesis, soot formation in flames and combustion offers a unique framework for understanding condensed-phase material formation in the gas phase. In this talk, we explore how insights from soot research can be leveraged to guide the synthesis of functional carbon nanomaterials. Specifically, I will discuss our recent efforts to synthesize nanographene and nanodiamond, using high-temperature plasma reforming and sooting flames coupled with surfactant solution trapping, respectively. We will demonstrate how the competition between thermodynamics and chemical kinetics can be precisely manipulated to control carbon phases and discuss the nuances required when using modern nanoscale characterization techniques.

Bio: Xian Shi is an Assistant Professor of Mechanical and Aerospace Engineering at the University of California, Irvine. He earned his Ph.D. in Mechanical Engineering from the University of California, Berkeley. His research investigates the fundamental dynamics of multi-phase, chemically reacting flows and materials, and explore conditions and configurations relevant to emerging energy, propulsion, and materials synthesis technologies. He is an AFOSR YIP recipient and a Hellman Fellow.

Hosted by: *Prof. Erdem Sasmaz*