SDSU College of Engineering Mechanical Engineering

Mechanical Engineering Seminar Series

February 17, 2026, 11:00AM

Dean's Conference Room, E-203E

Title: Nanostructure Engineering for Conducting Polymers and Superconductors for Energy Device Applications

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Abstract: Chemical vapor deposition (CVD) has emerged as a versatile and powerful manufacturing platform for producing high-quality electronic and optoelectronic materials with precise structural control. Recent advances are pushing CVD-based manufacturing to new frontiers, driven by its unique capabilities, including highly conformal coating of complex and porous architectures, solvent-free processing, tunable nanostructure and texture control, and compatibility with industrial-scale roll-to-roll (R2R) fabrication. These attributes make CVD particularly attractive for next-generation energy and electronic technologies. Advanced organic and inorganic conductors (such as conducting polymers and superconductors) serve as critical building blocks for modern devices. Their electrical conductivity, ionic transport, and optoelectronic performance are strongly governed by texture, molecular orientation, and nanoscale morphology. As a result, precise texture and nanostructure engineering provide a powerful pathway to tailor material functionality and accelerate the deployment of these conductors across a broad range of applications. This presentation will highlight recent progress in CVD-enabled manufacturing of advanced conductors, with a focus on oxidative CVD (oCVD) of conducting polymers and metal organic CVD (MOCVD) of superconducting materials. Case studies will be presented demonstrating the role of CVD-engineered materials in energy technologies, including perovskite solar cells, thermoelectric devices, redox flow batteries, and components for offshore wind turbine energy systems. Together, these examples illustrate how CVD-based manufacturing offers a scalable and transformative route for integrating advanced conductors into emerging energy, flexible electronics, and wearable electronic technologies.

Brief Bio: Dr. Meysam Heydari Gharahcheshmeh is an Assistant Professor of Mechanical Engineering with extensive expertise in materials science, energy devices, and advanced manufacturing. He completed his postdoctoral training in the Department of Chemical Engineering at the Massachusetts Institute of Technology (MIT) from 2017 to 2021 and earned his Ph.D. in Materials Science and Engineering from the University of Houston in 2017.He has recognized expertise in both organic conductors (e.g., conducting polymers) and inorganic conductors (e.g., high temperature superconductors), with a strong emphasis on CVD–based manufacturing, nanostructure engineering, and functional energy devices. His research spans solar cells, electrochemical energy storage, thermoelectric, and scalable organic and inorganic thin film processing. He has authored nearly 50 scholarly publications, including a U.S. patent, a book, a book chapter, and high-impact journal articles in venues such as *Nature Reviews Methods Primers*, *Science Advances*, and *Advanced Functional Materials*. His contributions to CVD-enabled manufacturing were recognized through multiple IEEE fellowships.