MECHANICAL & MATERIAL COLLOQUIUM

New frontiers for functional nanomaterials in energy and energetic applications

by Dibyendu (Dibs) Mukherjee (Department of Chemical, Environmental & Materials Engineering, University of Miami)

Enabling human-technology interfaces have propelled myriad nanotechnology applications for efficient and economical energy conversion, storage and dissipation systems. This seminar shall present our research on the synthesis and characterization of functional nanomaterials to address two critically interconnected areas of global significance - renewable energy for sustainability and energetic materials for national security. The talk will first introduce Laser Ablation Synthesis in Solution (LASiS) as a disruptive non-equilibrium technique for facile synthesis of tailored composite nanomaterials for energy conversion/storage and solid propellant applications. Specifically, the versatility of LASiS will be showcased via our recent syntheses of diverse classes of intermetallic nanocomposites (NCs)/nanoalloys (NAs), Metal Organic Frameworks (MOFs) and hybrid nanocomposites (HNCs) with structure-functionality relations tailored for electrocatalytic and supercapacitor activities. This will be followed by our results for C-interfaced shell-core Aluminum (Al) nanoparticles and metastable amorphous metal-oxide nanocomposites (Al-oxide/C NCs) synthesized as advanced energetic nanomaterials (ENMs). Such designer metastable ENMs surpass the stability and performance of 1st-generation metallized ENMs by bypassing their sluggish diffusion-limited burn rates. The talk will also briefly introduce Laser Induced Breakdown Spectroscopy (LIBS) for quantitative spectrochemical characterizations of composite nanomaterials, while demonstrating the use of deep learning models for LIBS spectral data analyses of semiconductor materials. The talk will conclude with an overview of our ongoing efforts to develop the next-generation laser ablation synthesis system, Programmable-LASiS (Pro-LASiS) as a large-scale data-driven nanomanufacturing platform.

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Dr. Dibyendu Mukherjee is an Associate Professor of Practice in the Department of Chemical, Environmental & Materials Engineering (CEME) at University of Miami, Florida, where he directs the *NanoBioMaterials Laboratory for Energy, Energetics & Environment (nbml-E^3)*. His research focuses on high-energy laser ablation techniques for synthesis, characterization and scalable manufacturing of functional nanomaterials for energetic and energy conversion/storage applications. His broader research interests also include bio-hybrid photo-electrochemical energy conversions. He holds 3 US patents on Laser Ablation Synthesis in Solution (LASiS)-based techniques for green synthesis of composite nanomaterials. He obtained his Ph.D. in Mechanical Engineering from University of Minnesota, Minneapolis followed by a postdoctoral position at the Oak Ridge National Lab (ORNL) and an Assistant Professor position at the University of Tennessee, Knoxville. He received the *2021 Defense University Research Instrumentation Program (DURIP)* award for developing the data-driven Programmable-LASiS platform. His research has been funded by AFOSR, ONR, DoE-Battelle, and NSF-IUCRC grant.

Place:
EC 1113

Time:
2:00-3:15 PM
Sept. 16, 2025

https://mme.fiu.edu/seminar-schedule

For questions or suggestions, contact Colloquium Organizers Dr. Jiuhua Chen (chenj@fiu.edu) or Dr. Pezhman Mardanpour (pmardanp@fiu.edu)