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Seminar: Monday, March 2– 10:30 A.M.—IP 231—INDY
https://purdue-edu.zoom.us/j/96912152372

AI-Enabled Multi-Process and Multi-Material Convergent Manufacturing

Abstract:
AI-enabled multi-process and multi-material convergent manufacturing offers a transformative pathway to fabricate multi-functional devices with tailored properties across scales. This seminar presents an integrated framework that combines process innovation, materials design, and data-driven intelligence. First, a novel multi-process in-situ rolled additive manufacturing platform (HI-RAM) is introduced, integrating laser additive manufacturing with in-situ micro-hot rolling to simultaneously optimize microstructure evolution and mechanical performance. A first-of-its-kind multi-scale, multi-physics thermal–mechanical–metallurgical modeling framework is developed to uncover the underlying process–microstructure–property relationships in HI-RAM. Second, multi-material manufacturing strategies for metal–metal and metal–ceramic systems are demonstrated using laser additive manufacturing and thermal spray. These systems are designed for extreme environments that require superior thermal, mechanical, irradiation, and corrosion resistance. Third, AI-enabled smart manufacturing approaches are presented through case studies in process control and materials design. Together, this work establishes a physics-informed, AI-enabled convergent manufacturing paradigm that unifies multi-process innovation, multi-material design, and data-driven intelligence to enable next-generation high-performance materials and multi-functional devices.

Biography:
Dr. Shunyu Liu is an Assistant Professor in the School of Mechanical and Automotive Engineering at Clemson University, with a courtesy appointment in Materials Science and Engineering. She earned her Ph.D. in Mechanical Engineering from Purdue University in 2020. Her research focuses on additive and hybrid manufacturing, multi-process and multi-material convergent manufacturing, smart and digital manufacturing, high-performance materials and coatings, and computational materials science. She has secured 10 externally funded research grants as PI and co-PI from NSF, DOE, and the U.S. Army. She has authored 28 peer-reviewed journal articles with over 4,100 citations. She is the recipient of the NSF CAREER Award (2023), the SME Susan Smyth Outstanding Young Manufacturing Engineer Award (2024), the NSF EPSCoR Research Fellowship (2025), and the South Carolina Manufacturing Mavens (2025). Her research integrates advanced manufacturing, materials science, applied mathematics, and data science to advance next-generation manufacturing technologies for high-performance materials and multi-functional devices.