

EPSTEIN INSTITUTE SEMINAR ▪ ISE 651

Multi-functional Additive Manufacturing of Smart Materials and Devices

ABSTRACT - By combining various materials that serve mechanical, electrical, chemical, thermal, and/or optical functions into a component with locally controlled distributions, we can produce composites and multi-material objects with a higher degree of functionality than would normally be found in a pure material part. In addition to material combination, by integrating hierarchical surface structures with dimensions spanning from nanoscale to macroscale, superior functions can be engineered and integrated into the component. However, to manufacture such multi-material multi-scale components directly out of a digital model without assembly, grand challenges still exist in material distribution and localized material phase control. In this talk, I will present our recent research in addressing these manufacturing challenges by integrating external fields in varied additive manufacturing processes. First, I will introduce external field assisted projection stereolithography technologies for productions of functional particle-polymer objects with hierarchical surface structures. After that, I will present a electrowetting-assisted direct ink writing technology for productions of conductive patterns on rough substrates at meters per second speeds for energy related applications. More energy related applications will be presented with a self-binding selective laser sintering method. In these additive manufacturing processes, I will discuss the effectiveness of integrations of external fields on controlling local material distributions and combining multiple materials. Applications of the 3D printed multi-functional materials and components in soft robotics, electronics packaging, and energy storage will be demonstrated.



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SPEAKER BIO – Dr. Yayue Pan is an Associate Professor in the Department of Mechanical and Industrial Engineering at the University of Illinois at Chicago (UIC). Her research focuses on multi-material and multi-functional Additive Manufacturing processes for applications in anisotropic composites, sensing and actuating devices, energy management and storage. Dr. Pan holds a Ph.D. degree from the University of Southern California. Some of her recent awards include Outstanding Paper Award in 41st SME NAMRC conference, 2017 SME Outstanding Young Manufacturing Engineer Award, 2017 UIC College of Engineering Faculty Research Award, 2020 ASME CIE TC Leadership Award, and several awards from National Science Foundation of United States.

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