SDSU | College of Engineering Mechanical Engineering

Mechanical Engineering Seminar Series

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EIS 104

Title: Multi-material Additive Manufacturing of Programmable Metallic Polymer Composites

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Abstract: On-demand 3D printing of polymer composites offers significant opportunities to enhance material functionality through tailored properties. In particular, metallic polymer composites have shown great promise in applications such as electronics, energy solutions, soft robotics, and four-dimensional printing, due to their unique combination of mechanical strength, high electrical/thermal conductivity, and ferromagnetic behavior. However, existing manufacturing techniques face limitations that restrict the concentration of filler materials in these composites, necessitating the use of low-viscosity slurry for printing. In this talk, I will report on some of our recent work on developing new multi-material additive manufacturing (AM) processes, including a hybrid AM process that overcomes these challenges by enabling the printing of highly concentrated metallic polymer composites, containing over 80% metal particles within the polymer matrix. Our approach successfully prints high-viscosity slurry (~500,000 mPa·s) in intricate matrix structures at precise, designed locations in both discrete and continuous patterns. The method is versatile, allowing for the fabrication of functional structures with customizable mechanical properties and multifunctional characteristics. Our innovative 3D printing technique offers a promising pathway for manufacturing metallic polymer composites with tunable magnetic and mechanical properties, opening up new possibilities for applications in soft-form sensors, actuators, and biomedical devices. I will present several test cases and discuss potential future applications.

Brief Bio: Dr. Yong Chen is a professor of Aerospace and Mechanical Engineering at the *University of Southern California* (USC). His research focuses on additive manufacturing (3D printing) and related modeling, control, material, and application. He has published 1 edited book, 4 book chapters, and nearly 200 publications in refereed journals and conferences, as well as 19 issued and pending U.S. patents. His work has been recognized by over 15 *Best/Outstanding Paper Awards* in major design and manufacturing conferences and research journals. Other major awards he received include the NSF *CAREER Award*, USC's *Innovation Commercialization Awards*, and invitations to the National Academy of Engineering *Frontiers of Engineering Symposiums*. Dr. Chen is a Fellow of the American Society of Mechanical Engineers (ASME). He has served as conference/program chair and keynote speaker at several international design and manufacturing conferences. At USC, Dr. Chen teaches students design and manufacturing-related courses. Nine Ph.D. students and post-doctors from his group have landed faculty positions in North American Universities. He also helped six Ph.D. students and two collaborators to create four startup companies related to 3D printing that have received over $350 million from venture capital funds.