Mechanical & Aerospace Engineering Colloquium Series
Spring 2018 Program

Wednesday, February 7, 2018
3:30 – 4:30 p.m. (refreshments/social hour at 4:30)
Easton Hub Auditorium (in the Fiber Optics Building)

Micro and Mesoscale Additive Manufacturing

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Abstract: In this work, we present a novel additive manufacturing method that uses printing of nanoparticles to fabricate a new class of three-dimensional (3D) micro-architected materials. Using controlled condensation and solvent evaporation in an aerosol jet based printing process, we have been able to achieve a precise arrangement of nanoparticles in 3-D space to give rise to hierarchical structures that span over five orders of magnitudes in length scale (micro to meso). Theories of dropwise hardening and evaporation are developed and validated through experiments to precisely control this process. Highly intricate 3-D micro-lattices, pillars, and spirals are demonstrated with a potential use in applications such as batteries, microelectronics, ultralight materials, and bio-probes. We have also developed methods to modulate the properties of such structures using different thermal treatments to allow grain growth and changes to porosity and hence changes in mechanical properties. We also carried out studies of electrical stability of printed 2D films and demonstrated their use sensor applications. Such films, because of their porosity result in high sensitivity for resistance based mechanical sensors and biosensors. The challenges associated with scaling of the printing methods are also discussed.

Bio: Dr. Rahul Panat received his MS in mechanical engineering from the University of Massachusetts, Amherst, and PhD in Theoretical and Applied Mechanics from the University of Illinois, Urbana. He worked at Intel Corporation in the area of microprocessor manufacturing R&D from 2004-2014. At Intel, Dr. Panat led a team of manufacturing engineers that developed the process for industry's first halogen-free IC chip. He joined Washington State University (WSU) in fall 2014 and then moved to CMU in fall 2017 and works in the areas of additive manufacturing, stretchable electronics, and Li-ion batteries. His research is funded by the National Science Foundation and the US Department of Energy. Dr. Panat is a recipient of several awards, including one at Intel for his work on the halogen-free chip.

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