MITMECHE

Colloquium

Mechanical Engineering Lecture in Design and Manufacturing

Additive Manufacturing Across Scales

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Friday November 18, 4:00PM, 3-270

Throughout history, innovations in manufacturing processes—such as movable type printing, and low-cost conversion of iron to steel—have catalyzed industrial growth and improved our standard of living. Now, additive manufacturing technologies, ranging from printing of low-cost electronics to automated assembly of large structures, promise to accelerate the scale-up of new products and reshape the constraints of supply chains. Toward this vision, I will first describe our research on high-resolution flexographic printing of electronic materials. Using nanoporous stamps comprising polymer-coated carbon nanotubes (CNTs) we achieve high-speed ultrathin micrometer-scale printing of colloidal inks, surpassing the resolution of industrial printing technologies by ~10-fold. With this I will share new insights on the dynamics of CNT forest growth, and methods for engineering microstructured CNT surfaces with tailored mechanical and interfacial properties. Next, I will introduce a high-speed desktop extrusion 3D printing system, which was devised by first analyzing the performance of current systems and then inventing a printhead that can build handheld objects in 5-10 minutes. These and other projects in my research group share a common approach of identifying and overcoming rate- and scale-limiting phenomena, which often impede the translation of new materials and processes to market. In closing, I will introduce 2.008x, the first massive open online course (MOOC) on manufacturing processes, and will share my experience creating this course and interacting with the global audience of learners.