

EPSTEIN INSTITUTE SEMINAR ▪ ISE 651

Multifunctional 3D Printing

ABSTRACT – The majority of 3D printing systems are designed to work with a single material at a time. Furthermore, the printed parts nearly always serve a structural function (i.e. plastic housings, titanium bone implants, etc.). A new generation of 3D printing technologies has started to emerge in which (a) multiple materials can be digitally blended to produce parts having heterogeneous properties, and (b) the deposited materials can serve more than just structural functions. For instance, polymer, metal, and ceramic nanoinks can be digitally combined to produce parts whose materials serve mechanical, electrical, thermal, optical, magnetic, chemical or other functions. While the applications for multi-functional printing are nearly endless, blending dissimilar materials within a part is not trivial. In addition to designing inks that are printable, inks must be developed in which properties such as surface tension, thermal processing temperature, coefficient of thermal expansion, and chemical bonding mechanisms are compatible for each material. From an industrial engineering perspective, the fact that these properties can change with time and processing conditions is particularly challenging. This talk will start with an overview of multifunctional printing technologies. The design of materials for compatibility with both the printing process and other materials will then be discussed along with results from selected multi-functional printing applications.



Dr. Denis Cormier

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SPEAKER BIO – Dr. Denis Cormier is the Earl W. Brinkman Professor of Industrial and Systems Engineering at the Rochester Institute of Technology. He has worked in the area of additive manufacturing (commonly known as 3D printing) for 20 years with a specific focus on aerospace materials and applications of metal additive manufacturing. Most recently, his research has focused on multi-material functional printing processes and materials. Prior to joining RIT in 2009, he was a professor at North Carolina State University for 15 years where he founded NC State's Rapid Prototyping Lab in 1996. He is a founding member of ASTM's F-42 additive manufacturing standards group, and he is a long-time organizing committee member for SME's RAPID conference and exhibition. He also serves on the editorial advisory boards for several journals including the *Rapid Prototyping Journal*, the *International Journal of Rapid Manufacturing*, and *Additive Manufacturing*.

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3:30PM – 4:50PM

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