Intelligent processing of materials

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**Abstract:** In the last century, the discovery of new elements in the periodic table allowed engineers and scientists to build structures stronger and lighter than ever before. At the end of the 20th century the periodic table was mostly completed, requiring new ways of improving material properties using methods such as alloying and heat treatment methods. Now these methods are also quickly being depleted as methods such as machine learning allow for high-throughput materials discovery, optimizing the needed composition of alloys quicker than ever before. Scientists now need to push the laws of physics to new levels in order to create tougher and better materials. Processing methods need to be found to make these new concepts work.

At the University of Virginia, the Intelligent Processing of Materials (IPM) lab uses several modified, high-tech processing methods to investigate new kinds of materials. An atmospheric plasma spray (APS) system has been adapted to allow spraying of ceramic materials onto SiC-based materials, a process originally used for decades in the aerospace industry to apply metallic coatings. Spark plasma sintering (SPS) has recently been used to make ultra-strong composites using carbon nanotube (CNT) sheets, equaling the material properties of carbon-fiber reinforced plastics without the use of epoxy. A modified electron beam physical vapor deposition (EB-PVD) technique has been adapted to allow more efficient deposition of materials and allow for in-situ control of the composition and microstructure of coatings for gas engine turbine blades, and hypersonic vehicle leading edges. Furthermore, the EB-DVD technique is now also used as a tool for research into high-throughput screening of refractory multi-principle/high-entropy alloys. This talk will introduce these techniques and discuss how fundamental physics and materials science are used to alter these techniques and improve the final properties of materials.

**Local Host:** Christina Rost (rostcm@jmu.edu)  
Please contact if you wish to set up a meeting with the speaker.