Qualification of Metal Additive Manufacturing: Role of High-Performance Computing and Ex-situ/In-situ Characterization Tools

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Abstract: Additive manufacturing (also known as 3D printing) of materials is considered as a disruptive technology to produce limited number of high value components with topologically optimized geometries and functionalities. Realization of the above potential for real-world applications is stifled by lack of standard computational design-tools; material characteristics, methods to probe thermo-mechanical processes under in-situ conditions, and microstructural homogeneity, as well as, anisotropic static- and dynamic-properties. This presentation will discuss the needed interdisciplinary science and technology ranging from robotics and automation, process control, multi-scale in-situ and ex-situ characterization methodologies, as well as, high-performance computational tools to address these challenges. Specific focus on understanding and controlling physical processes will be stressed, including powder/wire/tape, powder sintering, adsorption and dissolution of gases, microstructure evolution under extreme thermal gradients, and residual stress evolution under complex thermal gyrations. Two case studies will be presented that demonstrates the need for the interdisciplinary expertise to address challenges that face the adoption of additive manufacturing.

About the speaker: Dr. Babu obtained his bachelors degree in metallurgical engineering from PSG College of Technology, Coimbatore, INDIA and his master’s degree in industrial welding metallurgy-materials joining from Indian Institute of Technology, Madras. He obtained his PhD in materials science and metallurgy from University of Cambridge, UK in 1992. From 1993 to 1997, he held joint researcher position with ORNL, University of Tennessee and The Penn State University. From 1997 to 2005, he worked as an R&D staff at ORNL. From 2005 to 2007, Suresh held a senior level technology leader position in the area of engineering and materials at Edison Welding Institute, Columbus, Ohio. From 2007 to 2013, Suresh served as Professor of Materials Science and Engineering and Director of NSF I/UCRC Center for Materials Joining Science for Energy Applications, at The Ohio State University. In 2013, Suresh was appointed as UT/ORNL Governor’s chair of advanced manufacturing at the University of Tennessee, Knoxville, TN. Dr. Babu has published 180 journal papers and numerous conference proceedings. He has received many awards in recognition of his technical and leadership service to the materials and manufacturing community. He is a fellow of AAAS, ASM International and AWS.

In the last three years, Suresh has been instrumental and part of the team in securing UTK and ORNL’s leadership in NSF and Presidential initiatives related to national network of manufacturing innovation institutes. With his ability to foster collaborative activities with ORNL associates and UTK faculty, UTK has secured the following projects: NSF/IUCRC center for materials and manufacturing, Powder processing pillar of lightweight innovation for future (LIFT), and Institute for Advanced Composites Manufacturing Innovation Institute (IACMI).