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Additive Manufacturing of Diverse Materials for Green Future



Muhammad M. Rahman

*Assistant Professor of
Mechanical & Aerospace
Engineering*

University of Houston

ABSTRACT:

The progression of human civilization, from the time of the hunter-gatherers to the 19th-century Steel Age, has been shaped by various tool manufacturing strategies. Additive manufacturing is the latest of these strategies that have the potential to surpass the limitations of traditional manufacturing techniques due to the greater degree of design freedom, efficiency, manufacturing flexibility, and sustainability. Architected structures in nature, created from a limited number of biotic materials, demonstrate the importance of multiscale geometric design for both mechanical and functional performance. These natural materials offer significant advantages, including the development of sustainable composites, reduced reliance on limited fossil fuel-based resources, biological compatibility, and complete degradability. However, constructing complex structures from these materials is a challenge. Additive manufacturing technologies are unlocking new possibilities to implement this design paradigm with sustainable materials. In this seminar, I will present our efforts in addressing challenges and innovations toward manufacturing macro-scale architected structures with various sustainable materials for diverse applications, including load-bearing structures.

BIOGRAPHY:

Dr. Muhammad M. Rahman is an Assistant Professor in the Mechanical and Aerospace Engineering Department at the University of Houston. He received his Ph.D. from Cornell University, where he studied the structure-property relationship in biomaterials and biotic composites. Dr. Rahman has 14 years of experience in the fabrication and characterization of nanocomposites for various applications. He designs next-generation nanocomposites via advanced manufacturing technologies, including 3D printing, emphasizing sustainability for load-bearing structures, foods, textiles, energy, and environmental applications. He has published over 65 journal articles (h-index~34) in many prestigious journals, including Science Advances, Advanced Materials, Advanced Functional Materials, and ACS Nano. His research achievements have been featured by Science, Nature, BBC, New Scientist, and many other media outlets. Dr. Rahman has received several federal and industrial grants from the USA and Canada, including NSF and USDA, as Principal Investigator. He also received a first-place award in the sustainability category from the Create the Future contest by Tech Briefs 2021. He is the Climate Reality Project Leader trained by former vice-president Al Gore.