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Additive Manufacturing of Wood-based Structures

Beyer Distinguished Lecture

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Seminar Details

2:30-4:00pm

UH Campus
Classroom & Business Building
Room CBB 110

Online via Teams
https://teams.microsoft.com/meet/28672503493418?p=0CX16bX3BZZ6J5ss6O

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. Today, additive manufacturing represents the latest of these strategies, with the potential to overcome the limitations of traditional manufacturing techniques by offering greater design freedom, efficiency, manufacturing flexibility, and sustainability. For millennia, natural wood has served as a foundational material for buildings, furniture, and architectural structures. Yet conventional wood is typically shaped through traditional subtractive manufacturing, which generates substantial waste and inefficiency. Therefore, additive manufacturing (AM) of wood offers a sustainable opportunity to minimize and valorize wood waste. In this seminar, I will present our vision for additively manufactured wood through direct ink writing of natural wood components. We have pioneered an additive-free, water-based ink composed of lignin and cellulose, the primary building blocks of wood, that enables the 3D printing of architecturally designed wooden structures. The printed structures after post-processing closely resemble the visual, textural, olfactory, and anisotropic mechanical properties of natural wood. Then, based on this foundation, we leverage the AM process to address one of wood's most critical limitations: flammability. I will present our strategy for creating intrinsically fire-resistant wood via AM that meets the highest safety standards and surpasses the properties of natural wood.

BIOGRAPHY

Dr. Maksud 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 is an expert in the design, fabrication, and characterization of nanocomposites for multifunctional applications. He designs next-generation circular nanocomposites via advanced manufacturing technologies, emphasizing sustainability for structural, food, textiles, energy, and environmental applications. He has published over 75 journal articles (h-index ~37) in prestigious journals, including *Science Advances*, *Nature Communications*, *Advanced 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, USDA, Alberta Innovates, and Lockheed Martin as Principal Investigator. He is the Climate Reality Project Leader trained by former Vice President Al Gore.