

236 HELMERICH RESEARCH CENTER TUESDAY, APRIL 29, 11AM



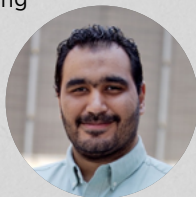
SCHOOL OF
**MATERIALS SCIENCE
AND ENGINEERING**
College of Engineering, Architecture and Technology

MSE SEMINAR SERIES

Integrated Manufacturing Approaches for High-Rate Composites

AHMED ARABI HASSEN PH.D.

Dr. Ahmed Hassen is the Group Leader for the Composites Innovation (CI) Group in the Manufacturing Science Division (MSD) at Oak Ridge National Laboratory (ORNL). He is leading ORNL's development efforts in high-rate manufacturing of advanced composites structures. Ahmed is leading ORNL's molds and dies manufacturing portfolio for the composite manufacturing industry. One of his leading efforts is to develop a vision and strategies for smart manufacturing of polymers and advanced composites aiming to advance the U.S. competitiveness in the global market of manufacturing. Dr. Hassen contributed to the creation of a new market for Additive Manufacturing (AM) technologies by developing a new class of composite feedstock materials for large-scale AM systems. He has expertise in a wide variety of composite manufacturing, characterization, and qualification methods and he is currently leading/managing several technical research efforts with a large funding portfolio in this field. Dr. Hassen is mentoring, supporting, and managing a group of undergraduate and graduate students (PhD and Masters), postdoctoral fellows, and junior/senior staffs. Dr. Hassen was serving on the Board of Directors (BOD) of the American Society for Non-destructive Testing (ASNT) and was the Chairman of the ASNT Research Symposium (2020-2022). He has published 90+ articles in high impact journals and proceedings, holds several patents, CAMX awards, holds nine issued patents, has received three R&D 100 Awards, named the 2021 Society of Manufacturing Engineers (SME), Jud Hall Composites Manufacturing Award recipient in addition to multiple honors and technical awards. Serves on the SAMPE Tennessee Valley Chapter Board and holds an adjunct professor appointment at the University of Tennessee at Knoxville.



ABSTRACT

Meeting the increasing performance and design demands of today's industries requires innovative approaches that integrate multiple manufacturing techniques into cohesive workflows. Convergent manufacturing provides a powerful solution by combining advanced processes, such as additive manufacturing (AM), machining, injection and compression molding, thermoforming, and tape layup, to enable multifunctionality, streamline production, and unlock new design possibilities. This presentation highlights cutting-edge strategies that integrate AM with downstream processes to enhance material properties, expand design freedom, and improve manufacturing efficiency. Key convergent strategies include; AM-integrated machining, which significantly improves dimensional accuracy, surface finish, and mechanical performance in large format AM structures; AM-enabled injection molding, that allows the creation of complex internal features and embedded functionalities; and AM-Compression Molding (AM-CM), which facilitates precise fiber alignment and structural optimization in molded composites. The talk will cover novel Additively Reinforced Thermoforming (ART) process, patented at Oak Ridge National Laboratory. This method merges AM with thermoforming to produce reinforced polymer sheets with tailored mechanical properties and scalable, cost-effective production. These hybrid manufacturing techniques reduce material waste and tooling costs, while enabling the fabrication of complex geometries and multifunctional components that are often unachievable with traditional methods. Applications across the aerospace, automotive, and energy sectors will be presented, along with technical challenges and system integration considerations, demonstrating how convergent manufacturing is reshaping the future of composite fabrication.

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