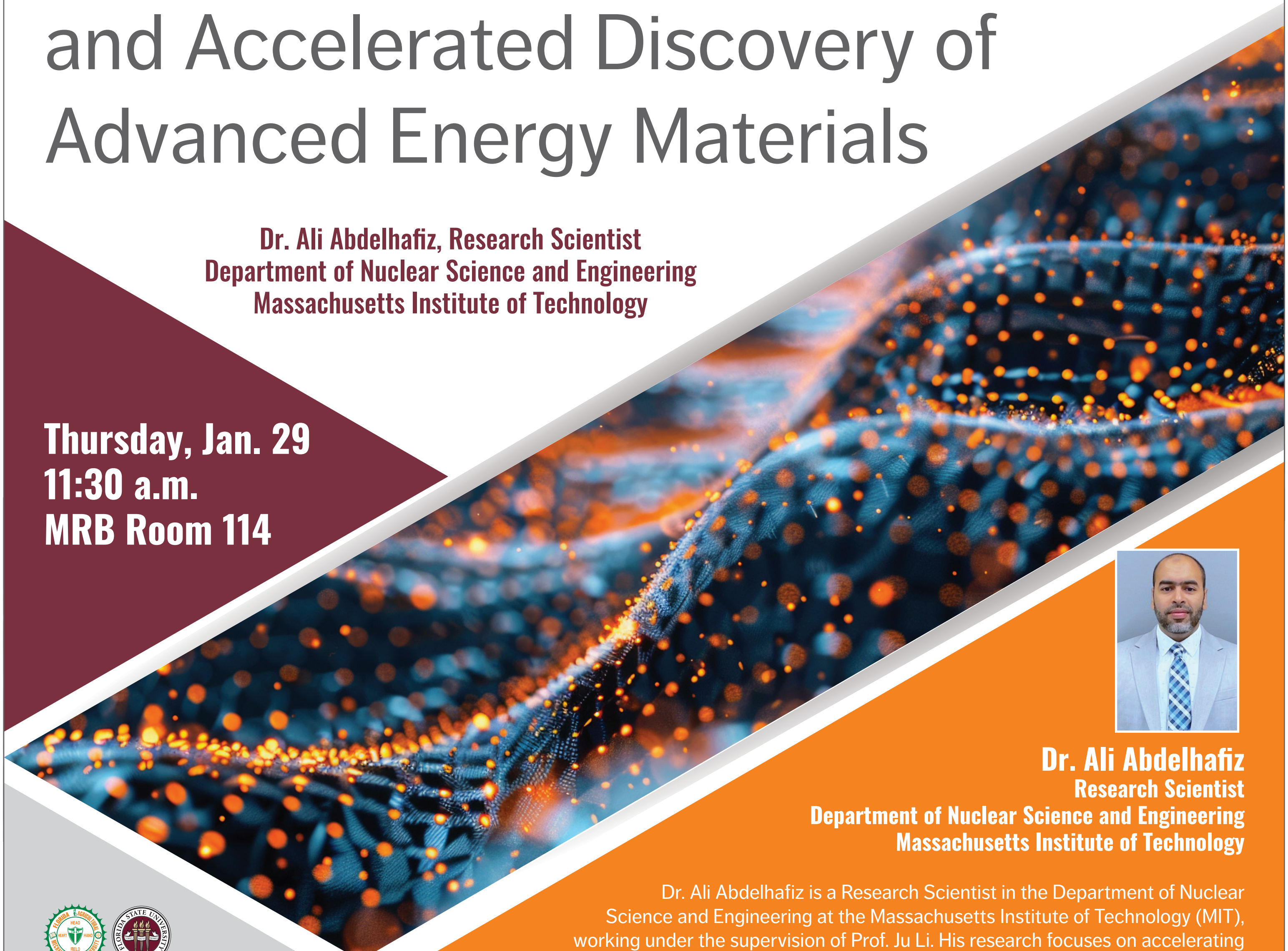
INDUSTRIAL & MANUFACTURING ENGINEERING SEMINAR ANNOUNCEMENT

Towards Autonomous Manufacturing and Accelerated Discovery of Advanced Energy Materials



Dr. Ali Abdelhafiz, Research Scientist
Department of Nuclear Science and Engineering
Massachusetts Institute of Technology

Thursday, Jan. 29
11:30 a.m.
MRB Room 114

Dr. Ali Abdelhafiz
Research Scientist
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Dr. Ali Abdelhafiz is a Research Scientist in the Department of Nuclear Science and Engineering at the Massachusetts Institute of Technology (MIT), working under the supervision of Prof. Ju Li. His research focuses on accelerating materials discovery through non-conventional high-throughput experimentation, with applications in green hydrogen production, CO_2 conversion into fuels and feedstocks, and the additive manufacturing of novel alloys and composites for radiation-resistant and nuclear applications. His work integrates autonomous robotic platforms to rapidly synthesize and test materials, significantly reducing the time and cost of discovery. Dr. Abdelhafiz earned his Ph.D. in Materials Science and Engineering from Georgia Institute of Technology, where he worked with Prof. Meilin Liu and Prof. Faisal Alamgir. His research at Georgia Tech centered on surface and interface engineering of atomic-scale metal/graphene hybrid electrocatalysts for fuel cell applications, as well as defect engineering of one-dimensional semiconductor nanoarchitectures for photoelectrochemical water splitting, water treatment, and desalination.

FAMU-FSU College of Engineering

This event sponsored by FAMU-FSU Engineering Department of Industrial & Manufacturing Engineering

The deployment of sustainable energy technologies is increasingly limited not by scientific feasibility, but by manufacturing constraints related to scalability, reliability, cost, and process control. In hydrogen production and utilization, electrocatalysts must operate at high current densities for thousands of hours while remaining compatible with industrial manufacturing workflows. Conventional materials development approaches, which rely on equilibrium synthesis and serial experimentation, are poorly suited to meeting these manufacturing-driven performance requirements.

In this talk, I will present a manufacturing-centric materials discovery framework that leverages non-equilibrium processing and reaction kinetics to directly encode functionality during synthesis. By treating surface and interface states as manufacturing variables rather than fixed material properties, this approach enables the rapid creation of high-entropy alloys and ceramics with exceptional catalytic activity and durability. These materials are produced using scalable, high-throughput manufacturing routes and evaluated under industrially relevant operating conditions.

The broader vision positions manufacturing and industrial engineering as the enabling layer that connects materials design to system-level deployment, providing a pathway toward scalable production of advanced energy materials with predictable performance, reliability, and lifecycle efficiency.