



William A. Brookshire
Department of Chemical
and Biomolecular Engineering
Cullen College of Engineering

ChBE Seminar Series

AI/ML in Additive Manufacturing and Polymer Synthesis for New Data and Discovery



Rigoberto Advincula

Governor's Chair Professor

Oak Ridge National Laboratory and University of Tennessee

Creating and curating new data appends the way we approach materials science. In additive manufacturing (AM), the fabrication of parts and objects with high complexity and high performance is advantageous over other methods. Using nanocomposites enables highly improved properties even with "commodity polymers" that do not need to undergo high-temperature processes or extensive reformulation. With artificial intelligence and machine learning (AI/ML), optimizing the formulation and manufacturing methods is possible. Using sensors capable of a feedback loop mechanism and the ability to use simulation to create digital twins, optimizing properties in record time is possible. Statistical and logic-derived design, including regression analysis, are starting points for designing experiments (DOE) or principal component analysis (PCA) in optimization and analysis vs trial-and-error approaches when working with polymer materials. In this talk, we demonstrate the approaches toward understanding Nanostructuring in composites and hierarchical approaches in optimization via AI/ML and other training/learning sets for specific properties and applications, such as 3D printing and flow chemistry reactions. Introducing more sensors (monitoring instruments) in AM processes and real-time ML with online monitoring allows a feedback loop and deep learning (DL) for autonomous fabrication and data analytics.

Rigoberto Advincula is a Governor's Chair Professor of Oak Ridge National Laboratory (ORNL) and the University of Tennessee, Department of Chemical and Biomolecular Engineering. He is also a Group Leader at the Center for Nanophase Materials Sciences (CNMS), ORNL. His area of expertise is in organic and polymer chemistry, nanomaterials, flow chemistry and reaction engineering, additive manufacturing, and biomaterials. He has led major projects including a machine learning (ML) flow chemistry lab at ORNL and advanced nanocomposite manufacturing with DOE. He is a Fellow of the National Academy of Inventors, the American Chemical Society (ACS), the Materials Research Society (MRS), and the Royal Society of Chemistry. He obtained his Ph.D. in Chemistry at the University of Florida and had Post-doctoral Positions at the MPI-P and Stanford University.

9/19/2025, 10:30 – 11:30am, L2D2