



## Integrated Smart Manufacturing Tools for Additive Manufacturing

### Abstract

Metal additive manufacturing (AM) opens opportunities for creating materials with complex geometries and unique microstructures but poses challenges in understanding their behavior and using current certification methods. The Manufacturing Demonstration Facility (MDF) at ORNL developed the Digital Factory, a cyber-physical setup for collecting and analyzing manufacturing data. This presentation highlights the connection between manufacturing data and physics-based models to develop a smart manufacturing framework for AM process analysis. We've created computational tools for process and microstructure simulations, designed for portability across computing architectures like distributed CPU/GPU supercomputers. These models are directly linked to process data, offering predictions that match experiments and providing insights into process dynamics and microstructure evolution that are hard to observe in situ. We'll present case studies on powder bed and directed energy deposition processes and discuss future directions for smart manufacturing.

### Speaker Bio

Alex Plotkowski is group leader for Computational Coupled Physics in the Computational Sciences & Engineering Division at Oak Ridge National Laboratory. Since joining ORNL in 2017, he has led large and diverse research teams to investigate advanced manufacturing processes, including development of modeling and simulation tools, design of new alloys for additive manufacturing, and operando neutron diffraction studies. He received his Ph.D. in Materials Engineering from Purdue University following a B.S.E. in Mechanical Engineering and M.S.E. in Product Design and Manufacturing from Grand Valley State University.



### Dr. Alex Plotowski

Group Leader for Computational Coupled Physics in the Computational Sciences & Engineering Division at Oak Ridge National Laboratory.

**Friday, February 21**  
**11:30 a.m.- 12:30 p.m.**

(1 - hour seminar with lunch and discussion).

### In-Person Only:

Location: GGB 2540 -  
Grand Conference Room

G.G. Brown Building  
2350 Hayward St, Ann Arbor

### Host and Organizer

Wenda Tan  
Associate Professor,  
Mechanical Engineering



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