

***Project 59-L: In-situ Visualization of Microstructure
Evolution in Metallic Alloys under Additive
Manufacturing Conditions***

***Semi-annual Fall Meeting
October 2021***

- Student: Oliver Hesmondhalgh (Mines)
- Faculty: Dr. Amy Clarke (Mines)
- Industrial Mentor: Dr. Joe McKeown (Lawrence Livermore National Lab)
- Other Partners: Dr. Alain Karma (Northeastern University), A. Saville (Mines), B. Rodgers (Mines)



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Project 59-L: In-situ Visualization of Microstructure Evolution in Metallic Alloys under Additive Manufacturing Conditions



- Student: Oliver Hesmondhalgh (Mines)
- Advisor: Dr. Amy Clarke (Mines)

Project Duration
PhD: August 2021 to May 2025

Purpose

- Understand microstructure development under AM conditions by experiments and modeling and the origins of grain refinement

Objective

- Characterize microstructures during simulated AM and after complex thermal cycling
- Inform phase field modeling for rapid solidification dynamics

Benefit

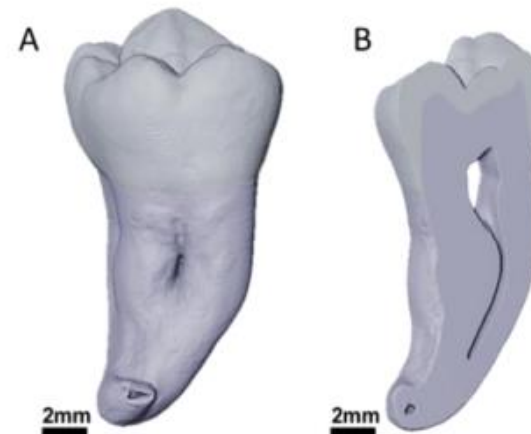
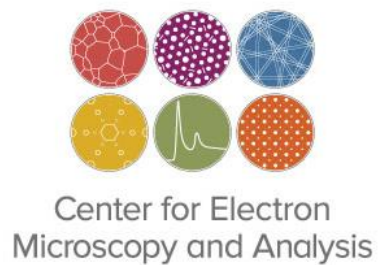
- Microstructure predication and control under AM conditions and insights into alloy design for AM matched to AM processes

Recent Updates

- Literature review in progress
- Coursework in progress
- Initiated equipment training
 - Dilatometer
 - Various SEMs
- Collaborating with current graduate students (A. Saville, B. Rodgers)

Metrics		
Description	% Complete	Status
1. Literature review	5%	●
2. Dilatometry to understand microstructure development during complex thermal cycling of Ti alloys	2%	●
3. Microscopy of Ti alloy microstructures to determine the origins of grain refinement	0%	●
4. In-situ imaging of Al alloys during simulated AM with Dynamic Transmission Electron Microscopy and/or at the Advanced Photon Source at Argonne National Lab	0%	●
5. Characterization of Al alloys after simulated AM	0%	●

About Me



Thank you!
Oliver Hesmondhalgh
hesmondhalgh@mines.edu