CANFSA

Center for Advanced Non-Ferrous Structural Alloys
An Industry/University Cooperative Research Center

Project 50: Understanding Influence of Heat-Treatment on Serrated Yielding in a Ni Superalloy and Hot Compression of Magnesium Alloys

Semi-annual Spring Meeting

April 2022

Student: Nathan Brown (Mines Undergraduate)

Faculty: Kester Clarke, Jonah Klemm-Toole, Amy Clarke (Mines)

Industrial Mentors: Chris Gatto (Honeywell), Bruce Antolovich (ATI), Scott Sutton (Mag Specialties)

COLORADO SCHOOL OF MINES NSF IOWA STATE UNIVERSITY

Understanding Influence of Heat-Treatment on Serrated Yielding in a Ni Superalloy

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- Student: Nathan Brown (Mines)
- Advisor(s): Kester Clarke, Jonah Klemm-Toole (Mines)

Project Duration
REU+MURF: May 2020 – May 2022

- Problem: Ni-based superalloys exhibit serrated yielding which results in increased strain at constant stress.
- Objective: Understand the origins of localized deformation that accompanies serrated yielding and determine/control the mechanisms responsible.
- Benefit: Improving the mechanical properties of Ni-based superalloys can lead to better performance and more efficient turbine engines.

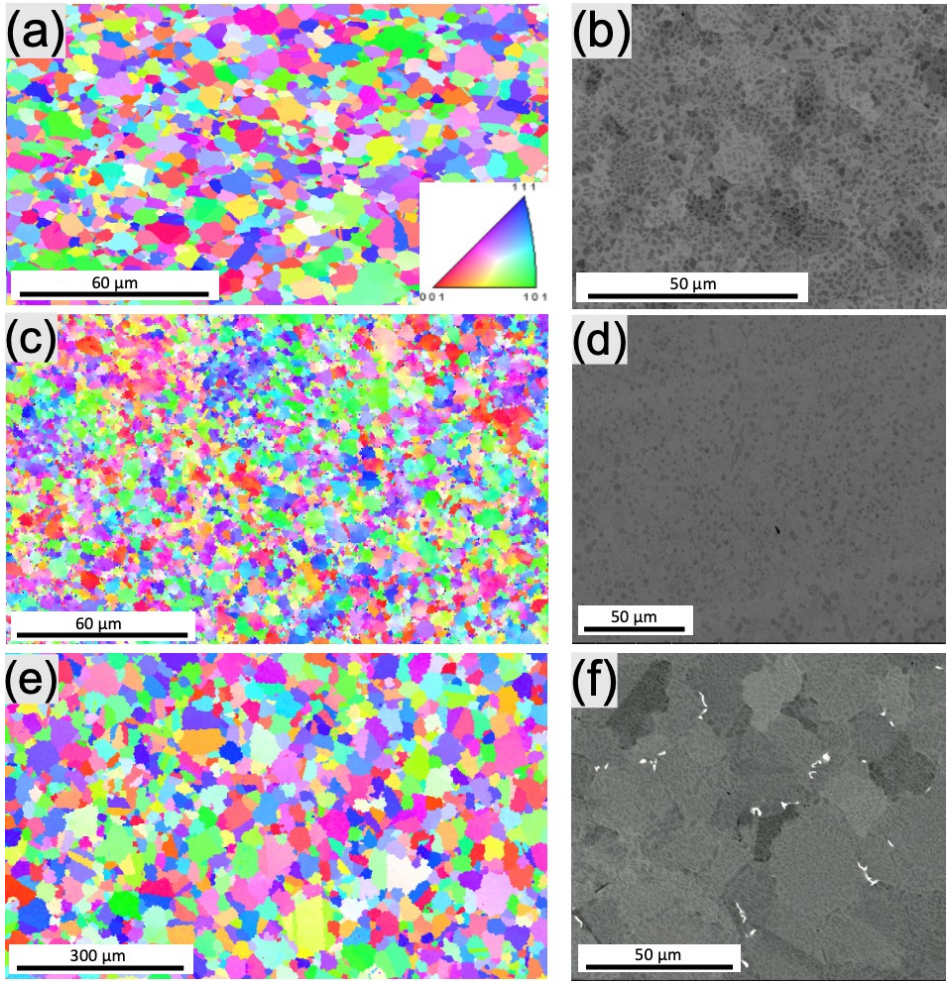
Recent Progress

- Material Characterization for ATI 720 PM, ATI 720 Wrought, Alloy 10
- Cylindrical Tensile Specimen Machining
- Load Frame Installation and Training

Metrics		
Description	**% Complete**	**Status**
1. Literature review	30%	●
2. Obtain Material / material machining	50%	●
3. As Received Material characterization	80%	●
4. Develop experimental testing matrix	75%	●
5. Conduct tensile testing	0%	●

Serrated Yielding in NI-based Superalloy Poster Outline

- Serrated Yielding Background
- Testing Setup
- Material Characterization
- Models Utilized for Future Work



Material characterization for ATI 720 PM (a-b), ATI 720 Wrought (c-d), and Alloy 10 (e-f)

Hot Compression of Magnesium Alloys

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Project Duration
REU+MURF: May 2020 – May 2022

- Problem: Novel Magnesium alloy dynamic recrystallization kinetics are not well understood
- Objective: Perform dynamic compression tests to allow for modeling of recrystallization mechanisms
- Benefit: Improving our understanding of magnesium processing windows can lead to increased control over material properties.

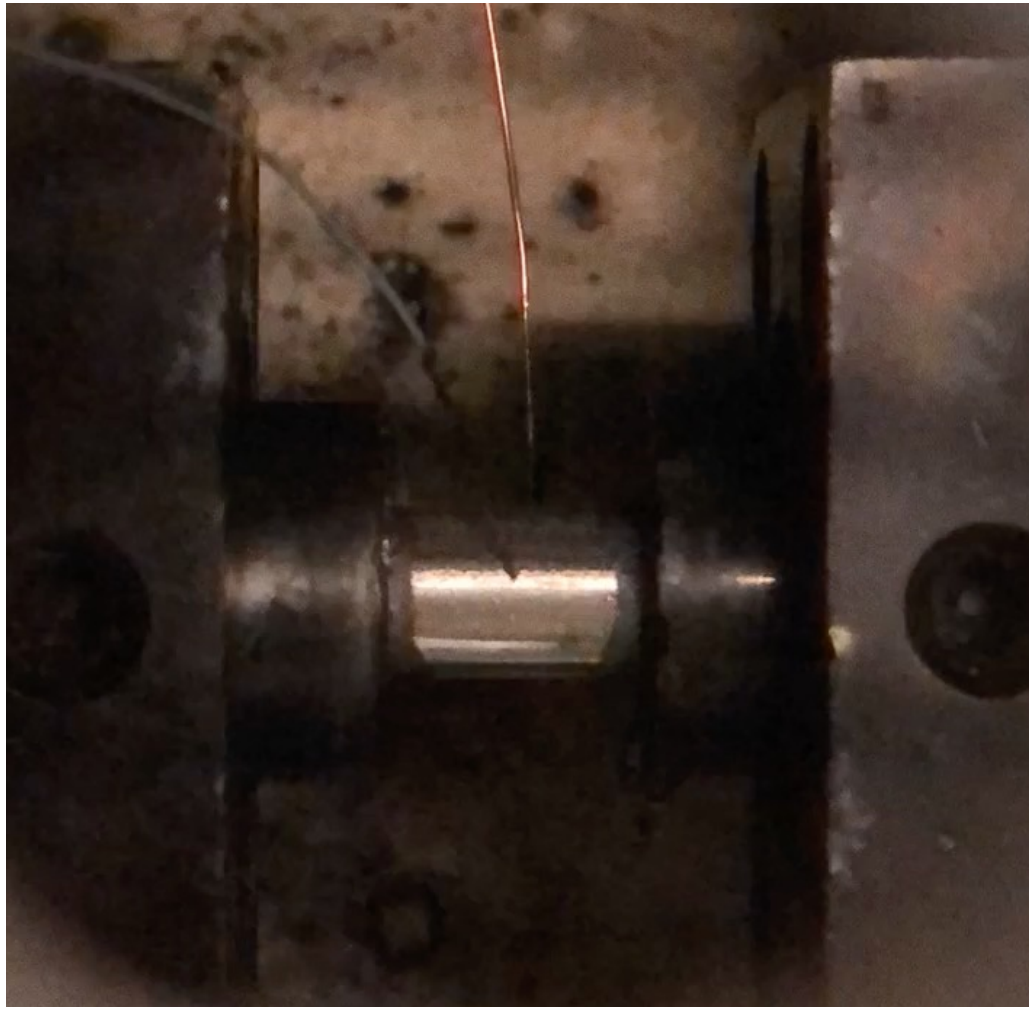
Recent Progress

- Testing procedure with the Gleeble 3500 have been established
- Compression testing

Metrics		
Description	**% Complete**	**Status**
1. Material Acquisition	100%	●
2. Compression Testing	15%	●
3. As received material characterization	0%	●
4. Post deformation material characterization	0%	●

Hot Compression Testing of AXZ911 Poster Outline

- Compression Testing Results
- Testing Setup Changes for Future Work



Time Lapse of $\dot{\varepsilon} = 0.01s^{-1}$ at 250˚C