CANFSA

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

Project 36H-L: Additive Manufacturing of Refractory Multi-Principal Element Alloys

Semi-annual Spring Meeting

April 2022

- Student: Megan Le Corre (Mines)
- Faculty: Dr. Amy Clarke (Mines)
- Industrial Mentors: TBD

Office of Naval Research ONR Science & Technology

COLORADO SCHOOL OF MINES NSF IOWA STATE UNIVERSITY

Project 36H-L: Additive Manufacturing of Refractory Multi-Principal Element Alloys

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- Student: Megan Le Corre (Mines)
- Advisor(s): Amy Clarke (Mines)

Project Duration
PhD: September 2021 to 2025

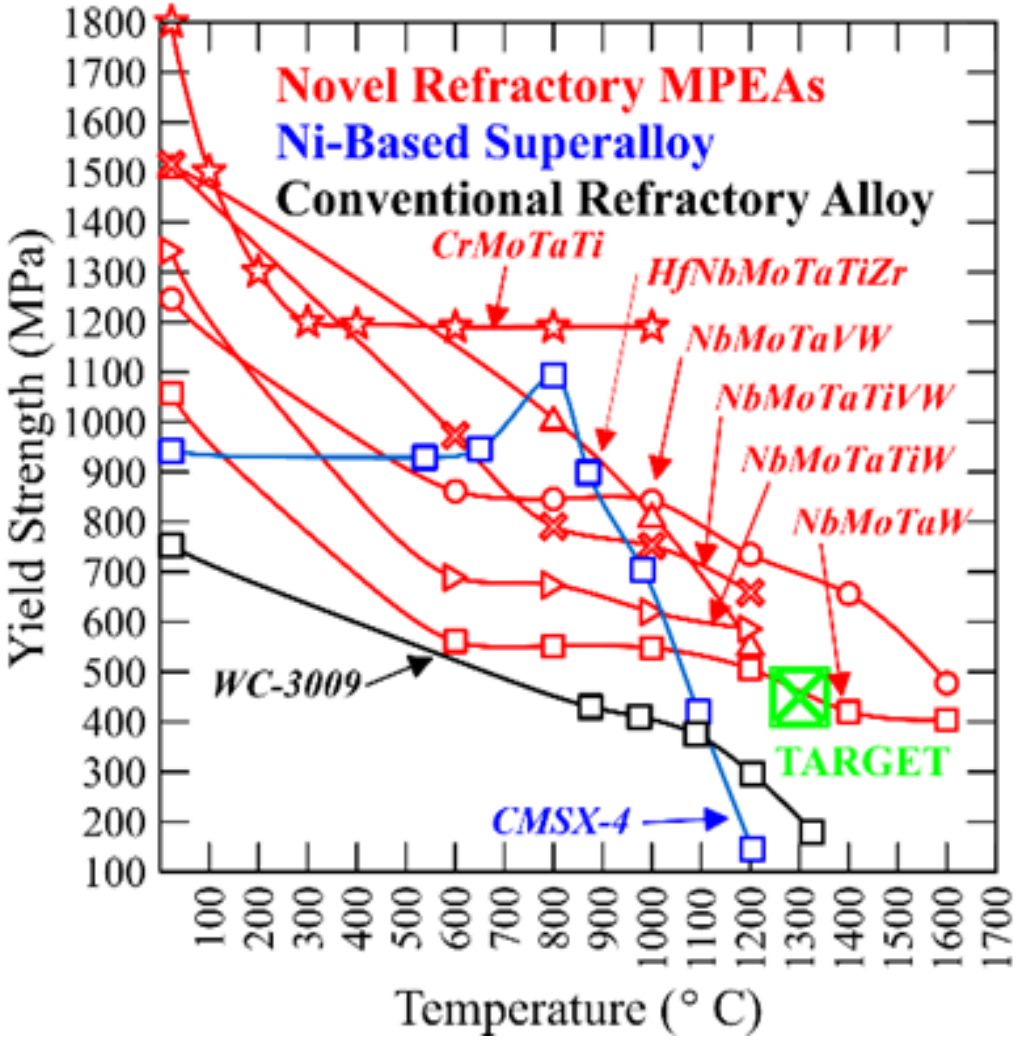
- Problem: Microstructure-processing relationship for additively manufactured refractory alloys is not well understood.
- Objective: Understanding role that processing conditions have on microstructure and how defects can be controlled.
- Benefit: Develop a more robust understanding of how AM can be used to design microstructure of RMPEAs and develop optimized compositions for AM processing.

Recent Progress

- Coursework
- Literature Review
- IMS and Columnar to Equiaxed Transition (CET) modeling of Nb-47Ti
- Initial laser track melts of Nb-47Ti
- Identified L-PBF platform capable of 800°C pre-heat

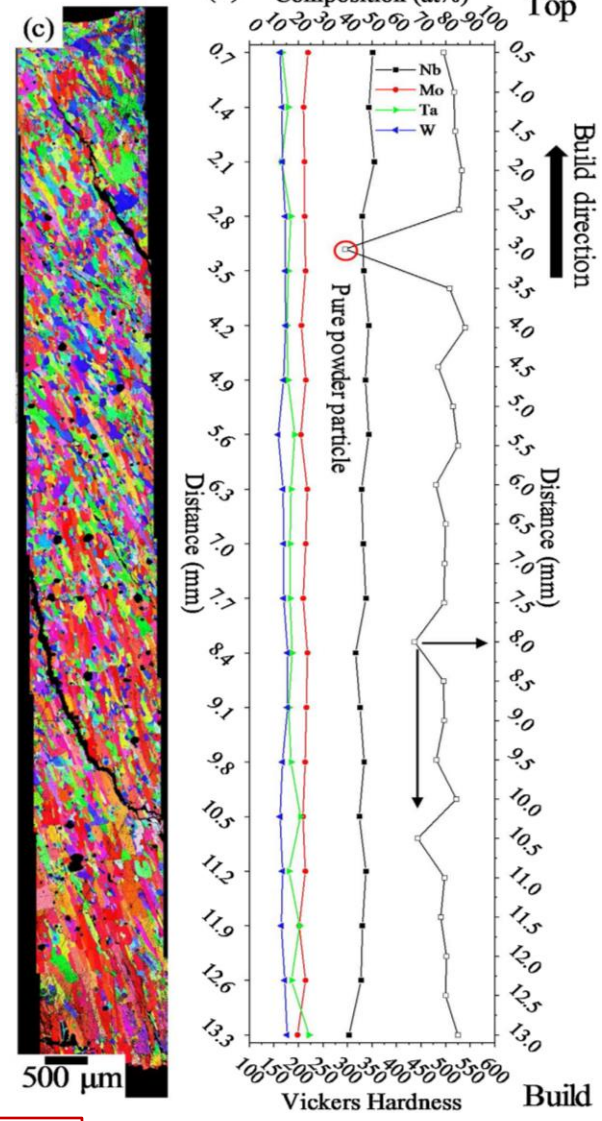
Metrics		
Description	**% Complete**	**Status**
1. Literature review	15%	●
2. Thermo-calc and solid solution modeling for alloy design	5%	●
3. Arc-melt new alloy buttons for laser track melts	0%	●
4. Laser track melts and correlate microstructure observations with AM processing conditions	5%	●
5. Columnar-to-equiaxed transition (CET) modeling	10%	●

RMPEAs: Properties and Challenges



- Promising properties compared to traditional alloys.
- Workability issues can be circumvented by AM.
- Challenges to be addressed:
  - Solidification cracking
  - Compositional variations

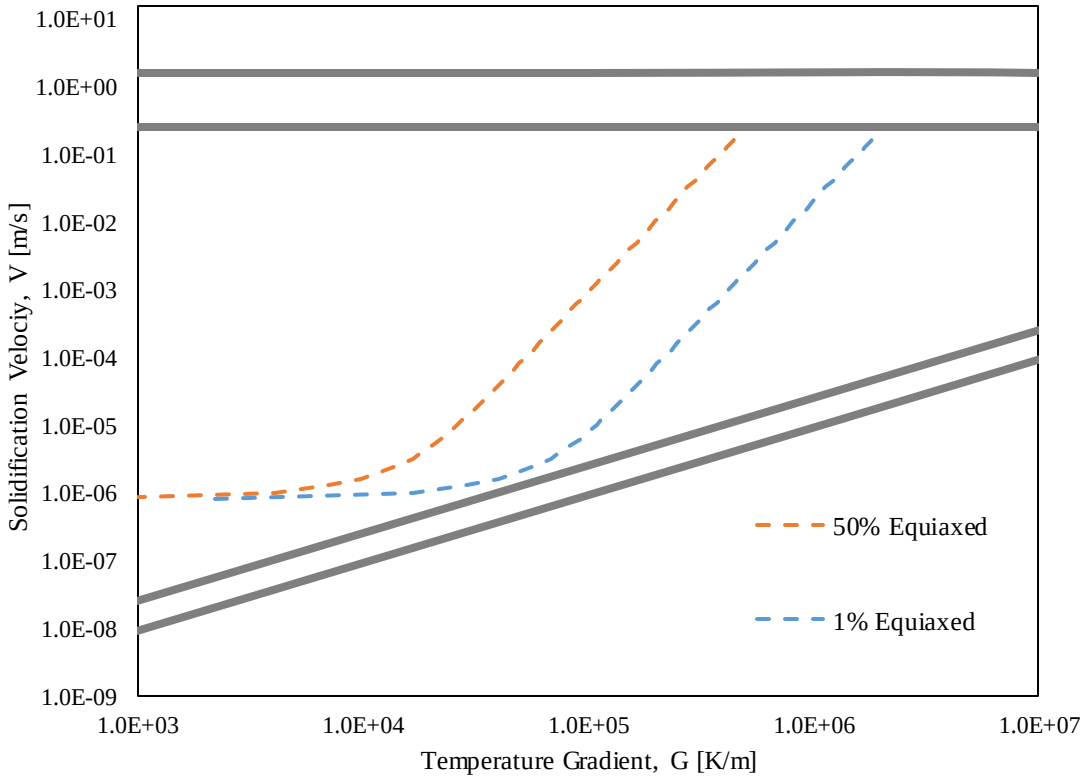
[1-6]



[7]

Recent Progress

Significant keyholing in Nb-47Ti laser track melt using published L-DED parameters



G-V regime and CET of Nb-47Ti

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