CANFSA

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

Project 62B-L: Maximizing Scrap Recycling by Designing Cu Tolerant Steel Compositions

Semi-annual Fall Meeting

October 2021

- Student: Henry Geerlings (Mines)
- Faculty: A. Clarke, K. Clarke, J. Klemm-Toole, S. Seetharaman (Mines)
- Industry Mentors: TBD

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

COLORADO SCHOOL OF MINES

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IOWA STATE UNIVERSITY

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- Student: Henry Geerlings (Mines)
- Advisors: A. Clarke, K. Clarke, J. Klemm-Toole, S. Seetharaman

Project Duration
August 2021 to August 2024

- Problem: High residual-containing scrap limits the ability to remelt steels without adding carbon-intensive blast-furnace pig iron to dilute compositions.
- Objective: Better understand effects of residual elements on downstream processing and component performance to enable design of viable composition-processing combinations.
- Benefit: Increasing residual element tolerance in steel products will reduce amount of needed pig iron dilution and associated carbon footprint, while increasing utilization of steel scrap.

Recent Progress

- Literature review under way
- Instrument training upcoming
- Project kickoff meeting 10/7
- Coursework under way

Metrics		
Description	**% Complete**	**Status**
1. Literature review	5%	●
2. Acquire and/or design materials	0%	●
3 Gleeble TMP and characterization.	0%	●
4. Thermodynamic modeling for alloy design	0%	●
5. Propose optimized compositions and processing pathways	0%	●

About Me

- B.S. Materials Science and Engineering (2015)
  - Emphasis in mechanics of materials and computational methods
  - Investigated Ti phase stability using MD, and developed algorithms for materials discovery

- M.S. Materials Science (2018)
  - Emphasis in applied mathematics and mechanics of materials
  - Researcher for ADAPT center developing high-throughput image analysis of SLM Inconel components and virgin vs. recycled powders

- Work Experience (2018 – 2021)
  - Materials Data Engineer for CoorsTek R&D
  - Developed data best-practices and various software tools and pipelines for ceramic formulation/processing data within R&D

Thank you!

Henry Geerlings
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Pubs (if relevant)

- [1] M. Poschmann, J. Lin, H. Geerlings, I. S. Winter, and D. C. Chrzan, “Strain-induced variant selection in heterogeneous nucleation of α -Ti at screw dislocations in β -Ti,” *Phys. Rev. Materials*, vol. 2, no. 8, p. 083606, Aug. 2018, doi: 10.1103/PhysRevMaterials.2.083606.
- [2] M. de Jong, W. Chen, H. Geerlings, M. Asta, and K. A. Persson, “A database to enable discovery and design of piezoelectric materials,” *Sci Data*, vol. 2, no. 1, p. 150053, Dec. 2015, doi: 10.1038/sdata.2015.53.