I/UCRC Executive Summary - Project Synopsis	**Date**: April 2021
Center/Site: CANFSA/Colorado School of Mines	
Tracking No.:40: Evaluation of Processing Path Effects on Microstructure and Properties of Powder-Based AL-TM alloys.	**E-mail :** sshirley@mines.edu **Phone :** (303) 406–1444
Center/Site Director: CANFSA/M. Kaufman/P. Collins/A. Clarke	**Type: (Continuing)**
Project Leader: Stuart Shirley (K. Clarke advisor)	**Proposed Budget**: $200,000
Project Description: This program focuses on processing path effects on microstructure and mechanical properties in the consolidation of Al-Transition Metal (Al-TM) powders. Solid state processing paths for powder consolidation of interest include: canned extrusion, and Shear Assisted Processing and Extrusion (ShAPE). Each of these paths will be evaluated for microstructure and mechanical properties. Additional thermomechanical processing will be conducted to develop understanding of forging effects on material produced by each of the processing pathways.	
Experimental plan: Microstructural and mechanical characterization of AL-TM alloys will be conducted after processing powder through multiple production paths. Initial experiments will focus on microstructural characterization of the processed powders.	
Related work elsewhere: A processing path for AL-TM metals via friction extrusion is under development at PNNL and is serving as a source for material for this thesis. University of Alabama has consolidated green powder compacts through AFSD and offered to consolidate Al-TM powder.	
How this project is different: This project seeks to further understand solid state processing path effects on microstructure of AL-TM powders. Previous studies of this alloy have mostly been constrained to evaluating extruded material containing the icosahedral precipitate as the primary strengthening phase.	
Milestones for the current proposed year: Produce Al-Tm extrusions at Michigan technological University. Microstructural characterization of ShAPE material, completion of thermal stability matrix and testing. Design thermomechanical testing matrix of aforementioned material.	
Deliverables for the current proposed year: Hardness results from thermal stability testing of extrusions and forging, with corresponding microstructural characterization showing evolution in microstructure. Hot hardness, and thermomechanical testing of Al-TM extrusions.	
How the project may be transformative and/or benefit society: This project will further develop understanding of forging and processing path effects on microstructure and properties of consolidated AL-TM powders.	
Research areas of expertise needed for project success: Metallography, mechanical testing, thermomechanical processing, metallurgy, understanding of materials processing paths. EBSD to evaluate grain size and texture of multiple solid-state consolidation processes.	
Potential Member Company Benefits: This project is of direct interest to Queen City Forge and other CANFSA members. Al-TM is an aluminum alloy with promising high temperature mechanical processing due to the potential to reduce production cost, energy costs and production time, as well as increasing operating temperature of aluminum parts.	
Progress to Date: Literature review. Al-TM material has been procured from the same nominal starting powder in (1) standard extruded form in multiple reduction ratios, (2) extruded material that has been subsequently forged, (3) ShAPE processed material, and (4) powder. Process development for microstructural characterization, and initial heat treatments have been performed.	
Estimated Start Date: Fall 2019	**Estimated Knowledge Transfer Date**: Fall 2021

The Executive Summary is used by corporate stakeholders in evaluating the value of their leveraged investment in the center and its projects. It also enables stakeholders to discuss and decide on the projects that provide value to their respective organizations. **Ideally, the tool is completed and shared in advance of IAB meetings to help enable rational decision making.**