I/UCRC Executive Summary - Project Synopsis		Date: October 2019
Center/Site: CANFSA/Colorado School of Mines		
Tracking No.: 36A Rationalization of Liquid/Solid and Solid/Solid Interphase Instabilities During Thermal-Mechanical Transients of Metal Additive Manufacturing	**Phone:** (303)-990-0939	**E-mail:** asaville@mymail.mines.edu
Center/Site Director: M. Kaufman/P. Collins/A. Clarke		**Type: (Continuing)**
Project Leader: Alec Saville		**Proposed Budget**: $240,000, Leveraged

Project Description: This project will focus on observing changes to crystallographic texture of electron beam melted (EBM) Ti-6Al-4V as a function of build scan strategy and build height. Three different scan strategies are employed to produce Ti-6Al-4V with different thermal histories and thus give rise to different conditions within each specimen. Neutron diffraction is used to develop texture profiles for each specimen both on a bulk scale and locally. With processing completed with the Material Analysis Using Diffraction (MAUD) software package and MATLAB-MTEX plugin, the goal of this project is to quantify differences in texture components between scan strategies and with build height. This will build a better understanding of processing-property relationships for additively manufactured (AM) titanium alloys, and give insights into controlling anisotropic behavior in AM builds. Development of a standard operating procedure for processing neutron diffraction data will also be developed, along with documentation and instructional materials.

Experimental plan: Texture data will be collected via bulk and local neutron diffraction experiments at Los Alamos National Laboratory and subsequently processed using the MAUD software package and MATLAB-MTEX plugin. Quantification of texture components for all experiments will be completed, enabling a numerical comparison of crystallographic texture as a function of scan strategy and build height.

Related work elsewhere: Experiments will be carried out at the HIPPO (High-Pressure-Preferred-Orientation) TOF neutron diffraction beamline at Los Alamos National Laboratory (LANL) to collect texture information. Training on MAUD and MATLAB-MTEX software will also occur at LANL and potentially at NIST-Maryland as the project evolves.

How this project is different: This project aims to develop a direct understanding of crystallographic texture evolution with varying scan strategies not seen in literature and probe how texture changes as a function of build height. This is a poorly understood aspect of AM materials, and needed for effective control of anisotropic properties.

Milestones for the current proposed year: Identifying the correct specimen symmetry to apply to data processing is one primary objective for the next reporting period. Quantification of texture components for each neutron diffraction experiment are also prioritized along with publication of all results once processing is complete.

Deliverables for the current proposed year: Deliverables for the current year include: publication of a journal paper summarizing results, video and document instructional materials detailing a standard operating procedure for processing neutron diffraction data, and summary reports to the project sponsor, the Office of Naval Research.

How the project may be transformative and/or benefit society: By understanding crystallographic texture evolution within AM builds and as a result of processing parameters, models and predicative capabilities can be updated for future AM efforts. This will increase general confidence in AM parts, enable new levels of control in material performance, and increase the deployment of AM into higher-end functional and structural applications.

Research areas of expertise needed for project success: Rietveld refinement, neutron diffraction, crystallographic texture, crystallography, and titanium metallurgy.

Potential Member Company Benefits: This project is of direct interest to LANL due to their involvement in completing neutron diffraction experiments. Results from this work can also give insight into anisotropic behavior of AM titanium components produced by member companies, helping to inform new predictive capabilities and troubleshoot present production issues.

Progress to Date: Literature review for AM and crystallographic texture has been completed. Neutron diffraction experiments and MAUD processing are complete, and texture component quantification is on-going with the help of experts across the US.

Estimated Start Date: Fall 2018	**Estimated Knowledge Transfer Date**: Spring 2022

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.**