

I/UCRC Executive Summary - Project Synopsis		Date: October 2020
Center/Site: CANFSA/Colorado School of Mines		
Tracking No.: 39: Solute and Precipitate Effects on Magnesium Recrystallization		E-mail: gkstorey@mines.edu
		Phone: (203) 240-4394
Center/Site Director: CANFSA/M. Kaufman/P.Collins/A.Clarke		Type: (Continuing)
Project Leader: Gillian Storey		Proposed Budget: \$200,000
<p>Project Description: Thermomechanical process simulation and mechanical testing will be performed on ZK60-based alloys to quantify the effects of solute and precipitation content on recrystallization. ZK60 is an ideal alloy for this study due to insoluble Zr particles that alter grain size and recrystallization mechanisms. The focus will be to utilize microscopy to characterize and quantify recrystallization mechanisms that are enhanced or retarded. This will lead to further investigation of mechanical and microstructural properties that are affected by altered recrystallization kinetics, such as, hot working flow stress, texture, etc. Initially classical Avrami parameters and Zener pinning parameters in static recrystallization for ZK60 will be determined and adapted to dynamic recrystallization and hot working. Further characterization will follow to ultimately study common industrial alloys using standard processing parameters modified to industrial benefit.</p>		
<p>Experimental plan: Classical Avrami parameters and Zener pinning parameters in static recrystallization for ZK60 will be determined. These parameters will then be adapted to dynamic recrystallization and hot working. Characterization and quantification of individual recrystallization mechanisms that are enhanced (or retarded) will then be performed. This will pave way for investigation of mechanical and microstructural properties that are affected by altered recrystallization kinetics. The Gleeble will be utilized to perform thermomechanical process simulation and the field emission scanning electron microscope with electron backscatter diffraction will be used for characterization.</p>		
<p>Related work elsewhere: A literature review is ongoing to determine other work that is ongoing related to Mg alloy recrystallization kinetics.</p>		
<p>How this project is different: Most studies on crystallization in Mg alloys focus on mechanisms that modify texture and reduce grain size, then recommend processing conditions that are not industrially viable. This project will use the context of easily measurable quantities, such as precipitate fraction and solute content, of the common industrial alloy ZK60 to give insight into standard processing parameters that can be modified for industrial benefit.</p>		
<p>Milestones for the current proposed year: Completed rolling of samples, followed by static recrystallization (SRX) trials. Quantify and characterize individual recrystallization mechanisms. Perform thermomechanical process simulation to study dynamic recrystallization (DRX) using the Gleeble.</p>		
<p>Deliverables for the current proposed year: Classical Avrami parameters and Zener pinning parameters will be delivered within a static recrystallization model for the five modified ZK60 alloys. Characterization and quantification of individual recrystallization mechanisms through the field emission scanning electron microscope with electron backscatter diffraction. Demonstration of thermomechanical process simulation and dynamic recrystallization using the Gleeble.</p>		
<p>How the project may be transformative and/or benefit society: This project seeks to further advance the understanding of standard processing parameters for commercial magnesium ZK60 alloy for industrial benefit. Will determine the effect of microstructural development kinetics on hot working parameters and material properties.</p>		
<p>Research areas of expertise needed for project success: Microscopy, image processing, image analysis, metallurgy, materials science, materials processing.</p>		
<p>Potential Member Company Benefits: This project is of direct interest to Mag Specialties Inc.</p>		
<p>Progress to Date: Experimental materials have been procured with varying Zr and Ce content. Initial rolling of experimental ZK60 samples has been performed. Initial static recrystallization heat treatments. Etching of experimental ZK60 and initial analysis of grains through optical microscopy and scanning electron microscopy.</p>		
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.**