Synopsis
A series of four friction stir welds created at different processing conditions on an AZ80 magnesium extrusion have been compared in terms of texture, microstructure, tensile performance and defects to examine the impact of changes in the welding speed and rotational rate during processing. In particular, the interface between the weld and the base material is a region of interest, as this is the typical location of failure during tensile testing. Synchrotron and EBSD examinations of this interface in two perpendicular planes are presented, and the effect of processing conditions on the weld texture is discussed. Finally the results of preliminary EBSD texture measurements taken along the length of the weld are contrasted to existing literature results in AA2195 aluminum [1].

Introduction
Friction stir welding (FSW) is solid-state joining technology that uses a non-consumable rotating pin to generate frictional heat and soften the material into a plastic state. The tool then progresses while continuing to rotate, moving the plasticized material towards the rear of the tool as shown schematically in Figure 1. By decreasing the total heat input and simultaneously inputting plastic strain to trigger recrystallisation of the material, the resulting microstructure is finer grained and offers several advantages as compared to conventional fusion welding techniques.

The interface between the weld and the base material is the most frequent location of failure. Currently texture is assumed to be the critical factor and results of some preliminary EBSD investigations in this area will be presented.

In most studies of Friction stir welding, the process is assumed to involve constant, homogeneous flow in the longitudinal direction, however multiple experiments have been conducted indicating and that at least in some cases formation of the weld occurs by deposits of successive layers of deformed material [1,2,3]. Evidence that this is the case in the current series and comparisons of measured textures to those found in other alloys will be made.

Methods and Results
Microstructures of two welds of different processing conditions are presented from three different planes. The micro-textures in several areas of the longitudinal-transverse plane (Fig. 2) were characterized by electron-back-scattered-diffraction (EBSD), and synchrotron x-ray diffraction scans were made from the transverse plane. EBSD is challenging in Mg alloys for many reasons, including the low atomic number of Mg, difficulty in preparing surfaces, and shelf life of surfaces to oxidation. It was found that electropolishing approaches were impractical and ion milling was a superior preparation method for the materials studied here. The long-term goal is to combine the EBSD and synchrotron texture information to develop a better understanding of this complex deformation process, with a focus on interface and longitudinal effects.

Conclusions
The texture of FSW are not symmetric about the centerline, constant through the depth or identical between processing conditions. Periodic microstructural variations along the length are likely confined to a small portion of the weld volume. Further textural investigations will be a valuable source of insight for greater understanding of failure mechanisms across the interface.

References
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