**Internship for USTB:**

Microstructure evolution of Al-Sc-Zr alloy after friction stir process

The requirements for materials with improved mechanical properties and light weight is one of the major challenges of modern society as these materials imply less energy consumption and enhanced mechanical safety. Al-Sc-Zr alloy is a new precipitation-strengthened lightweight alloy.[1-4](#_ENREF_1) As the particle size and distribution of Al3(ScxZr1-x) precipitations can be controlled by different aging process, the strengthening mechanism of Al-Sc-Zr alloy depends significantly on the influenced of these Al3(ScxZr1-x) precipitates. [1](#_ENREF_1), [2](#_ENREF_2)

As a major method of enhancing mechanical properties of alloys, plastic deformation will be utilized in this study, thus the investigation of deformation mechanism of Al-Sc-Zr alloy and the consequential microstructure effects on the mechanical properties is a fundamental study of this project. Friction stir process (FSP) is can be used for microstructural modification and property enhancement in cast aluminum alloys.5 Until now, few works have been published to relate the microstructure and the properties of deformed Al-Sc-Zr alloy in considering materials anisotropy and heterogeneity.

In this study, Al-Sc-Zr alloy after FSP will be investigated to study the microstructure evolution, crystalline anisotropy of plastic deformed Al-Sc-Zr alloy. The microstructure evolution of deformed Al-Sc-Zr alloy will be studied by SEM-FEG (precipitates, morphology, EDX); the crystalline anisotropy will be studied by EBSD with SEM-FEG and by pole figures with X-ray diffraction (XRD).

***Reference:***

1 Keith E. Knipling, Richard A. Karnesky, Constance P. Lee, David C. Dunand, and David N. Seidman, 'Precipitation Evolution in Al–0.1sc, Al–0.1zr and Al–0.1sc–0.1zr (At.%) Alloys During Isochronal Aging', *Acta Materialia,* 58 (2010), 5184-95.

2 Keith E. Knipling, David N. Seidman, and David C. Dunand, 'Ambient- and High-Temperature Mechanical Properties of Isochronally Aged Al–0.06sc, Al–0.06zr and Al–0.06sc–0.06zr (At.%) Alloys', *Acta Materialia,* 59 (2011), 943-54.

3 E. A. Marquis, and D. N. Seidman, 'Nanoscale Structural Evolution of Al3sc Precipitates in Al(Sc) Alloys', *Acta Materialia,* 49 (2001), 1909-19.

4 G. M. Novotny, and A. J. Ardell, 'Precipitation of Al3sc in Binary Al-Sc Alloys', *Materials Science and Engineering a-Structural Materials Properties Microstructure and Processing,* 318 (2001), 144-54.

5 R. S. Mishra, and Z. Y. Ma, 'Friction Stir Welding and Processing', *Materials Science and Engineering: R: Reports,* 50 (2005), 1-78.

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