Title - Spectral Fatigue Behavior of AZ31 Magnesium During Variable Loading
Program of Study – Mechanical Engineering

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Abstract

In many industries such as the automotive and aerospace, Magnesium is an essential lightweight structural material frequently used to accomplish greater efficiency. For an increase in efficiency and effectiveness, a better understanding of the metal and its behavior in strenuous conditions is needed. Magnesium is useful since it is a lightweight abundant material as stated by the National Mineral Information Center “Magnesium (Mg) is the eighth most abundant element and constitutes about 2% of the Earth's crust, and it is the third most plentiful element dissolved in seawater.” (Bray, 2022). It is commonly used to reduce weight in vehicles and aircrafts to increase efficiency. Indirectly it also reduces emissions and helps with the environment. Cyclic loading is what many machines experience such as plane wings. It is continuous strain where, that strain level can be shifting from high to low this is known as spectral loading. To better understand this and prevent fracture It is important to have accurate models that represents fatigue damage mechanisms to better understand AZ31 in various spectral loading conditions. Both crack nucleation from twin boundaries and local twinning at crack tip (which are not common in most metals) complicate fatigue modeling efforts. Current fatigue models such as the Coffin-Manson model and Miner’s rule do not accurately account for load history effects in complex load sequencing. This research investigates fatigue behavior with strain amplitudes of 0.3%, 0.4%, 0.5%, 0.6% and spectral loading in various conditions such as Low to High amplitude 0.3%->0.5%, 05%->0.3%, 0.4%->0.6%, and 0.6%->0.4% strain amplitude. These tests will allow us to evaluate fatigue models and their ability to predict fatigue failure under complex loads. This work includes fractographic analysis of the fatigue specimen, microstructure characterization, and a comparison of several fatigue models.

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Citations

Bray, L. (2022) *Magnesium statistics and information* , *Magnesium Statistics and Information* | *U.S. Geological Survey* . Available at: https://www.usgs.gov/centers/national-minerals-information-center/magnesium-statistics-and-information (Accessed: February 18, 2023).