When high strength aluminum alloys are subjected to liquid metals, physical and chemical reactions ensue resulting in what is known as liquid metal embrittlement (LME). A subset of environmentally-assisted cracking, LME is exhibited when a liquid metal, e.g. Hg or Ga, comes into intimate contact with a solid metal having significant susceptibility. As mechanical loads are applied, the interaction between the two metals results in a reduction in the flow properties of the solid metal. Several theories have been proposed to identify the underlying microstructural failure mechanism; however, none have been widely accepted, as failures can typically incorporate features common to several failure theories. In an effort to confirm, extend or replace the physically-based theories, fracture mechanic experiments on Al 7075-T651 in liquid mercury have been conducted. Experiments were conducted in a custom environmental chamber capable of exposing specimens to liquid environments while applying a mechanical load. Through both plane-strain fracture and stress intensity factor-dependent (SIF) tests, fracture toughness values along with incubation periods were analyzed and provided data for a load-based theory of LME. These mechanical test data, along with metallographic analysis, show that the phenomena of LME is both strongly time- and SIF-dependent.

Major: Mechanical Engineering

Educational Career:
Bachelor's of Mechanical Engineering, BS, 2008, University of Central Florida

Committee in Charge:  
Dr. Ali P. Gordon, Chair, MMAE  
Dr. David Nicholson, MMAE  
Dr. Seetha Raghavan, MMAE

Approved for distribution by Dr. Ali P. Gordon, Committee Chair, on October 13, 2009.

The public is welcome to attend.