STRUCTURE-PROPERTY RELATIONS IN THE Al-Gd-Ni SYSTEM

B. Ye[1], T. Watson[2] and B.S. Majumdar[1]
[1]Materials Department, New Mexico Tech, Socorro, NM 87801
[2]Pratt&Whitney, East Hartford, CT 06108
Contact: majumdar@nmt.edu, 505-835-5152

Structure-property relations were investigated for a new class of alloys in the Al-rich side of the Al-Gd-Ni system. The material was fabricated from a near amorphous rapidly solidified powder, followed by hot consolidation and extrusion. The primary precipitates had an elongated plate or needle-like morphology and were brittle. The structure and atom locations in the precipitates were determined by electrolytic extraction of precipitates, followed by detailed X-ray analysis and Rietveld fitting procedure. By suitable alloy selection and processing route, it was possible to maintain extremely fine precipitate size. Thereby reasonable ductility was obtained while retaining strength between 560 and 700 MPa. The effects of processing steps on tensile and fracture toughness properties will be discussed. The mechanisms of deformation were investigated using sequentially loaded specimens and scanning and transmission electron microscopy. Based on these studies, a quantitative model will be presented in an attempt to relate the mechanical properties to the microstructure. We acknowledge the support of DARPA under the SAM initiative.