



CSU PHYSICS COLLOQUIUM

Ultrafine Grained Precipitation Hardened Aluminum Alloys

Speaker: Kaka Ma

Department of Mechanical Engineering, CSU

Colorado State University

4:00 PM Monday, August 28, 2017

Refreshments at 3:45 PM

Location: 120 Engineering (Hammond Auditorium)

Abstract

The strategy of creating nanostructures has been applied in a variety of metals and alloys to achieve unprecedented mechanical properties. Primary approaches include: (1) reducing the grain size to the nanoscale for Hall-Petch strengthening, and (2) using phase transformation to introduce nanoscale precipitates for dislocation shearing or Orowan strengthening. When precipitation occurs in alloys with nanoscale or ultrafine matrix grains (i.e., with a high volume of grain boundaries), the complexity in microstructural evolution leads to significant challenges in predicting and understanding the corresponding mechanical behavior. Using Al-Mg-Zn-(Cu) alloys as a model system, this talk will provide an overview of recent work on ultrafine grained Al 7000 series alloys and their enhanced mechanical performance. Coupling of intragranular dislocations and precipitates in ultrafine grains as well as lamellar grain structure with low angle grain boundaries led to simultaneous improvement in strength and ductility.

Biographical Sketch

Dr. Ma received her B.S. in materials physics from University of Science and Technology of China in 2006 and earned her Ph.D. in materials science and engineering from University of California (UC), Davis in Dec. 2010. Before joining Colorado State University as a tenure-track assistant professor, she performed postdoctoral research at UC Davis and UC Irvine. She was also an instructor for an upper-division undergraduate course, titled "Materials Selection in Engineering Design", at UC Davis. Dr. Ma's research interests sit at the interface of materials science, mechanical engineering, and sustainability. She is interested in innovation of advanced

nanomaterials with high performance, improved reliability, and extended lifetime. Her previous research focused on fabrication and characterization of nanostructured or ultrafine grained materials ranging from thermal barrier coatings, aluminum alloys to metal matrix composites. Her recent research activities focus on multiple-scale precipitation strengthened Al alloys and composites, metal additive manufacturing (AM) and sustainability issues associated with AM. She has published thirty peer-reviewed and referred journal papers and has given more than thirty presentations (six invited) at international technical conferences such as TMS and MS&T. Dr. Ma serves on the editorial board for the journal Materials Science and Engineering A and serves as a reviewer for several international circulated journals, including Metallurgical and Materials Transactions A, Nature Communications, Scientific Reports, Surface and Coatings Technology, Journal of Alloys and Compounds, etc.