T_CSUH Special Seminar

Texas Center for Superconductivity at the University of Houston

Prof. New-Jin Ho

Institute of Materials Science and Engineering
and Center for Nanoscience and Nanotechnology
National Sun Yat-sen University
Kaohsiung, Taiwan

"In-Situ Formation of Nanoscaled Al_2O_3 in Al-ZnO System by Friction Stir Technique"

Monday, February 5, 2007

Room 102, University of Houston Science Center
12:00 p.m. – 12:45 p.m.
12:45 p.m. Sandwich Lunch

RSVP by Friday, February 2, 2007, to 713-743-8210

Abstract

In past years, we have successfully blended nano-Al_2O_3 into aluminum alloys with excellent dispersion by friction stir processing. The strength and ductility of this composite is superior to those made by sintering and casting. In addition to successful blending of nano particles in the stir zone, we also found ultra-fine grains ranging from several microns to one hundred nanometers. Nevertheless, it was difficult to make clustering and grain sizes smaller even with adding a large amount of nano-particles unless an in-situ formation of nano oxides occurs.

It was well understood that aluminum can redox most of metal oxides to produce Al_2O_3 during sintering process at high temperature. An Al-ZnO system was first chosen because zinc is soluble in aluminum at high temperature to form stable alloys at room temperature. The preliminary results indicate that Al_2O_3 as small as 2 nm~10 nm without nano-clustering can be made in the Al-Zn matrix. According to Orowon strengthening mechanism, the shear strength can be as high as G/20, or 1.5GPa.

Further investigations will be carried out to

(1) understand how a large amount of ultra-fine nano Al_2O_3 were formed at temperatures lower than 600°C, and within a short period (<1 sec) of the friction stir process,

(2) understand the crystallographic change in 2nm~10nm Al_2O_3 from amorphous state to gamma- and to alpha-phase, and at what size is the change irreversible comparing to constraint-free nano-Al_2O_3, and

(3) understand the effect of such fine nano-Al_2O_3 in excellent dispersion condition on the mechanical properties—such as strength, ductility, low cycle fatigue, fatigue crack propagation, and fracture toughness.

Bio

Prof. New-Jin Ho, after receiving his Ph.D. from University of Illinois at Urbana-Champaign in 1983, started his faculty appointment at the Institute of Materials Science & Engineering at National Sun Yat-sen University in Taiwan. Now, he is the director of the Center for Nanoscience and the Center for shared Facilities at the university, for which he had also helped to set up the Research Affair Program 10 years prior to the present position. He has worked on fatigue damage of materials and surface treatment for many years, most of which are concentrated on the threshold limit and dislocation morphologies around fatigue crack tips using electron microscopic technique and the clustering effects on cyclic hardening or softening. Recently, he has also joined the nano programs and started to work on the in-situ formations of nano-sized oxides and ultra-grain-refinement in aluminum alloys using friction stir techniques.

Persons with disabilities who require special accommodations in attending this lecture should call (713) 743-8210 as soon as possible.

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