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IAS Distinguished Lecture

Recent exploration on thin film or porous metallic glasses for MEMS and biomedical applications

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Date : 17 January 2017 (Tuesday)
Time : 10:00am – 11:30am *(Light refreshments will be served from 9:30am to 10:00am)*
Venue : Mr & Mrs Ho Chun Hung Lecture Theatre (LT-12), Green Zone, 4/F, Academic 1, City University of Hong Kong

Abstract

This talk will present some of the recent efforts and progress on the metallic glasses in forms of monolithic or multilayered thin films and porous foams for MEMS and biomedical applications. The work includes (1) high toughness metallic glasses and their composites; (2) porous metallic glasses for bio-implant; (3) metallic glass thin film coating; (4) multilayered metallic glass thin films and their micro/nano-scaled mechanics; (5) application of metallic glasses in MEMS, micro-imprinting for optical micro-lens and surface hologram patterns for anti-forgery; (6) high light reflection or high light transmission thin film metallic glasses for optical uses; (7) MD simulation of metallic glass atomic structure and nano mechanics; and (8) 3D printing additive manufacture of Ti based graded porous foams for replacement of human cortical and cancellous spine bone. So far, our team has developed a few biocompatible Ti-based (e.g., Ti-Ta-Si-Zr), Ta-based (e.g., Ta-Zr-Cu-Ti), bio-degradable Mg-Zn-Ca, anti-microbial Ag-Mg-Al thin film metallic glasses. In addition, the combinations of nanocrystalline thin films and metallic glass thin films into multilayered laminated composite structures have attracted attention. The nanocrystalline thin films under examination include the pure Zr, Cu, Mg, Ag, Au, or binary and ternary alloy systems. The metallic glass thin films include the model ZrCu, TiZrTaSi, TiZrSi, AgMgAl, AgCuAl, MgZnCa, etc. The interface between the nanocrystalline metal film and metallic glass thin film could be in sharp or graded nature, and could be in horizontal or inclined (30, 45 or 60 degree) orientation with respect to the film and substrate. Such laminated films with sharp/graded or flat/inclined interfaces are commonly seen in semiconductor, optoelectronic or biomedical multilayered structures. The film composition, relative layer thickness, interface nature, interface strength, surface roughness, and surface hardness are all of concern. The characteristics of the resulting laminated films are compared with those of the monolithic nanocrystalline metal films and monolithic metallic glasses.

Biography

Prof. Jacob C. Huang has been the Senior Vice President National of Sun Yat-sen University (NSYSU) and the National Chair Professor, Taiwan. He received his BS degree from National Tsinghua University, Taiwan, in 1979, and his MS and PhD degrees from UCLA, in 1983 and 1986. He has been the post-doc research fellow in Los Alamos National Laboratory, USA, in 1987-1989, and advanced to associate, full, and chair professors in NSYSU in 1989, 1994, and 2006, respectively. He has acted as department chair, dean, chair of institutional research (IR) office, and vice president in NSYSU, and program manager in National Science Council (NSC) and vice chair of MRS-T society in Taiwan. He has been awarded many times by NSC and Ministry of Education of Taiwan, as well as TECO Award, Ho-Jin-Tua Award, Lu-Chih-Ming Award, elected as MRS-T and ASM Fellow, and finally awarded as National Chair Professor in Taiwan, the highest honor for engineering academic award. He has also been the Editor of Materials Letters.

His research areas include metallic glasses, nanocrystalline materials, light metal alloys, composites, high temperature plastic forming, mutltilayers and laminates, and biocompatible metals. He has published more than 300 journal papers, and many conference papers and patents. Professor Jacob Huang's most significant contribution in worldwide basis might be his pioneer starting research in low temperature superplasticity (LTSP) and thin film metallic glasses (TFMG). In addition, he has devoted to the realization and promotion of academic research to the industrial application in Taiwan. For example, he developed thermomechanical treatments on various Al alloys for China Steel Corp-Aluminum Corp, Taiwan. He also developed forming techniques for Mg and Al enclosures for cell phones and laptop computers for Catcher and Foxconn Corp, two of the world largest supplier for metal casings for Apple iPhone, Acer Computer, Asus Computer, and HTC cell phone Companies. In the past five years, he developed thin film metallic glass coatings for optical and thermal devices and effectively transferred the technology to several local companies. His recent progress on 3D printing additive manufacture of TiZrTaSi based biocompatible graded porous foams for replacement of human cortical and cancellous spine bone has been exciting.

All are welcome

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