

Seminar

Date: 18 August 2009 (Tuesday)
Time: 11:00 am - 12:00 pm
Venue: EF 305, The Hong Kong Polytechnic University

Potential Applications of Metallic Glasses: Thin Films and Nano-/Microforming Parts

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Abstract:

There has been a significant progress in the development of bulk metallic glasses (BMG) in recent years. In this presentation, the potential applications of metallic glasses in the fields of thin films and nano-/microforming are given. First, the extensive amorphization in glass-forming thin films annealed in the supercooled liquid (ΔT) region is revealed. Such controllable extensive amorphization throughout the thin film is useful to regulate the proportion of amorphous phase to crystalline phase, establish the structure/property relationships and thus tailor specific properties.

In addition, the application of 200 nm-thick metallic glass films has resulted in significant improvements in the four-point bending fatigue property of stainless steel. The fatigue life is found to improve from 4.4×10^5 cycles of uncoated sample to 4.5×10^6 cycles of coated sample under a stress of 750 MPa. The life is further increased to $>10^7$ cycles, more than 22 times, when the film is annealed in ΔT . The excellent fatigue properties are attributed to the several factors, such as smooth surface, high film strength and good adhesion between film and stainless steel.

Finally, I will demonstrate that optical gratings with good diffraction properties can be produced by nanoimprinting of BMG in air. BMG is selected because the material has high room-temperature strength and excellent viscous flow property in ΔT . In ΔT , BMG exhibits unusually low thermal expansion and viscosity, thus malleable for forming devices with complicated shapes. While there are many reports on the micro-scale forming, very few investigations on the properties of nanostructured BMG (such as optical properties) have been performed. Therefore, the forming of BMG in the nanoscale remains to be challenging from both the scientific and engineering points of views. The perspectives of nano-/micro-forming of BMGs will be presented.

Biosketch:

Prof. Jinn P. Chu obtained PhD degree in Materials Science and Engineering at University of Illinois at Urbana-Champaign in 1992. He is now working as Executive Editor at Journal of the Chinese Institute of Engineers. He has 6 patents (11 pending), over 170 papers in journals and conference proceedings. More than 50 invited presentations given in universities in Taiwan and abroad as well as in international conferences. His current research interests include nano-/microforming of bulk metallic glasses and various metallic and oxide thin film depositions with the emphases on annealing-induced amorphization in glass-forming films and the barrierless Cu metallization.

* Refreshment will be served after the seminar.