Department of Mechanical Engineering
機械工程學系

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

Seminar

Date: 16 July 2009 (Thursday)
Time: 11:00 pm - 12:00 pm
Venue: EF 305, The Hong Kong Polytechnic University

Fatigue and Fracture Behavior of Bulk-Metallic Glasses

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Abstract:

Bulk-metallic glasses (BMGs) are a relatively new class of engineering materials. After Zr-based amorphous alloys with a high glass-forming ability and thermal stability were discovered in 1990, the alloy design increased the critical casting thickness to several centimeters, and a homogeneous dispersion of nanoscale particles was found to improve the ductility. Therefore, BMGs are being studied widely because of their potential as structural materials. The fatigue behavior is an important characteristic of structural materials and critically important for life predictions and failure analyses in engineering applications. The factors affecting the fatigue behavior of the BMGs and their composites are discussed. In order to broaden the scope of applications of BMGs, a fundamental understanding of the fatigue behavior is critical for the design of new alloy systems and the development of the processing techniques. Although BMGs generally exhibit high strengths and high fracture toughness, they demonstrate a wide range of fatigue lives and limits (8 - 50 % of the ultimate tensile strength). Moreover, the real nature of the fatigue mechanisms in BMGs is still unclear. Here fatigue mechanisms in BMGs are clarified. The fatigue cracks in BMGs were found to initiate from shear bands near defects, such as machining/polishing damage. A plastic zone, which is created through the formation of many shear bands, exists at the crack tip. The fatigue crack, then, propagates along these shear bands. One fatigue cycle indeed produces one fine striation spacing instead of one coarse striation spacing.

Biosketch:

Peter K. Liaw was born in Chiayi, Taiwan. He graduated from the Chiayi High School, obtained his B.S. in Physics from the National Tsing Hua University, Taiwan, and his Ph.D. in Materials Science and Engineering from Northwestern University, USA, in 1980.
He is the Director of the National Science Foundation (NSF) Integrative Graduate Education and Research Training (IGERT) Program, the Director of the NSF International Materials Institutes (IMI) Program, and the Director of the NSF Major Research Instrumentation (MRI) Program at UT. Several of his graduate students have been given awards for their research and presentations at various professional societies and conferences. Moreover, his students are teaching and doing research at universities, industries, and government laboratories.

* Refreshment will be served after the seminar.