

Seminar

Date: 22 July 2009 (Wednesday)
Time: 11:00 am - 12:00 pm
Venue: EF 305, The Hong Kong Polytechnic University

Micro, Nano, Micro/Nano Micropropulsion, Nano Energetic Materials, Micro/Nano Initiator

Dr. Kaili Zhang

Department of Manufacturing Engineering and
Engineering Management, City University of Hong Kong

Abstract:

Microspacecraft/satellite is one application of MEMS in space field. The low-cost and reliable clusters of microspacecraft have more merits than a conventional spacecraft in fabrication, launch and operation. In a microspacecraft, a micropropulsion system is required for station keeping, attitude control, and orbit adjust. New silicon and ceramic solid propellant microthrusters will be presented. They have more design flexibility, higher fabrication efficiency, and better bonding quality compared to previous approaches.

Energetic materials (EMs) including propellants, explosives, and pyrotechnics have found diverse civilian and military applications. Nano EMs have improved performances in energy release, ignition, and mechanical properties than their bulk/micro counterparts. A novel nano Al and CuO nanowire based nEM (also called nano thermite composite) will be discussed, which has several advantages over previous investigations such as enhanced contact, tailored dimensions, and easier integration into microsystem.

Electro-explosive devices (EEDs) activated by electrical energy are used to initiate an explosive, burning, electrical, or mechanical train. EEDs have found numerous civilian and military applications including triggering the inflation of airbags in automobiles, micropropulsion, arm fire/safe devices used in missiles/rockets, and many other ordnance systems. An innovative EED is developed by integrating Al/CuO nEM with a Au/Pt/Cr micro heater on a substrate. It allows batch fabrication and high level of integration and reliability.

Lastly, our research on TiO₂ nanoparticles, 1D carbon nanotubes, 2D NiO nano walls/honeycombs, 3D nano Mg and Cr will be briefly mentioned.

Some refs: *JMEMS*, 16(4), 919, 2007; *Nanotechnology*, 18(27), 275607, 2007; *APL*, 91(11), 113117, 2007; *JMEMS* 17(4), 832, 2008.

Biosketch:

Kaili Zhang received the B.E. degree in mechanical engineering in 1997 from Dong Hua University, China. He obtained the PhD degree in microsystems at National University of Singapore in 2006. From 2006 to 2008 he worked on nanosystems as a postdoc at Laboratory for the Analysis and Architecture of Systems, French National Center for Scientific Research (LAAS-CNRS). From 2008 to 2009 he worked on carbon nanotubes as a postdoc at Swiss Federal Institute of Technology Zurich (ETH Zurich). He is now working as an assistant professor at Department of Manufacturing Engineering and Engineering Management, City University of Hong Kong. His current research interests include nano energetic materials, nano metals / metal oxides, micro igniter, solar cell, and fuel cell.

* Refreshment will be served after the seminar.