



**NANYANG  
TECHNOLOGICAL  
UNIVERSITY**  
SINGAPORE

College of Engineering

## Distinguished Speaker Lecture Series

**17 October 2017, 4.00 pm**

**Lecture Theatre 4, Nanyang Technological University**



### Recent Development of Nanomaterials for Advanced Mechanical and Energy Systems

#### **Professor Jian Lu**

*Chair Professor of Mechanical Engineering, Vice-President  
(Research & Technology), Dean of Graduate Study  
City University of Hong Kong (CityU)*

#### About the Talk

To develop high efficient and advanced mechanical system, the creation of new materials and associated systems is one of the key directions. This presentation will feature recent development of structural nanomaterials and high mechanical properties of functional nanomaterials for the potential applications in unmanned mechanical systems. The mechanisms of nanomaterials processing with different nano-structures by high efficient physical methods will firstly be reported by illustrating our latest findings / research progress on the nanomaterials with high strength and high ductility, nanostructure materials with gradient structure, hierarchical nano-twinned materials, materials with nano-precipitation, nanomaterials with multiphase embedded structure. We will also present our recent work on an approach that combines the strengthening benefits of nanocrystallinity with those of amorphization to produce a dual phase material that exhibits near-ideal strength at room temperature and without sample size effects. Our magnesium-alloy system consists of nanocrystalline cores embedded in amorphous glassy shells, and the strength of the resulting dual-phase material is a near-ideal 3.3 GPa—making this the strongest magnesium alloy thin film yet achieved. This work demonstrates a new way of producing a supra-nanostructure in a controllable manner. We anticipate numerous applications related to the material's exceptional mechanical properties and other functional properties, for example as biodegradable implants with excellent wear resistance etc. The feasibility of applying other nanomaterials on various advanced robotics, transportation and energy systems; such as soft robotics, robotics in challenging environment (nuclear plant), ocean exploration and thermal energy conversion will be discussed. The application of new nanomaterials on the light-weight vehicle will be introduced. Lastly, the development and research direction of the biomimetic nanostructured materials on advanced unmanned mechanical systems will be discussed.

#### About the Speaker

Professor Jian LU is the Chair Professor of Mechanical Engineering; Vice-President (Research & Technology) and Dean of graduate study at the City University of Hong Kong (CityU). He commenced his undergraduate education in 1978 at Peking University where he was selected based on his score in the national examination for a national scholarship for overseas study in 1979. He obtained the Dip. Ing., Master (DEA) degree and Doctoral degree from University of Technology of Compiègne in 1984 and 1986 respectively. From 1986 to 1994, he was appointed as Senior Research Engineer at the CETIM (French Technical Centre for Mechanical Industry).

In 1994, he was appointed as Professor; Head of Department of Mechanical Systems Engineering and Director of Mechanical Systems and Concurrent Engineering Laboratory jointly supported by the French Ministry of Education and CNRS at the University of Technology of Troyes, France. From 2005 to 2010, he was Chair Professor and Head of Department of Mechanical Engineering at the Hong Kong Polytechnic University. In 2010 to 2013, he was the Dean of College of Science and Engineering at CityU, and from 2013 till now, he serves as the Vice-President (Research & Technology) and Dean of Graduate Studies of CityU.

## About the Speaker

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Professor LU's primary research interest is advanced nanomaterials and its integration in mechanical and biomedical systems using the combination of experimental mechanics and mechanical simulation. He has also branched out into several other areas of interest including surface science and engineering, biomechanics, residual stresses, and mechanics of nanomaterials. He has published more than 350 SCI journal papers including papers in Nature (cover story), Science, Nature Materials, Nature Communications, Materials Today, Advanced Materials, PRL, Acta Materialia, and Journal of the Mechanics and Physics of Solids.

Professor Lu has received the French Knight of the National Order of Merit and French Knight of the National Order of Légion d'Honneur in 2006 & 2017 respectively. Both awards were nominated by the President of the Republic of France and awarded by the French Government. In addition, he was elected as the 1st Chinese-born French Fellow by the National Academy of Technologies of France among 300 Fellows in 2011.

