14:03–202A+B

Size-dependent behavior in nano-dielectric Bernoulli-Euler beam

Xu Liang[†], Shengping Shen
State Key Laboratory for Strength and Vibration of Structures, School of Aerospace, Xi'an Jiaotong University, Xi'an, China
size-dependent behavior of a Bernoulli-Euler dielectric nanobeam based on the strain gradient theory/surface theory is presented. the governing equations and boundary conditions are derived from the variational principle of the electric Gibbs free energy density. Different from the classical beam theory, size-dependent behavior in nano dielectric beam is described. A cantilever beam problem is studied to shown the size-dependent behavior in elastic, dielectric (Non-piezoelectric) and piezoelectric beam. Comparision to the classical beam theory and the new beam model is given. It is clearly shown that the normalized deflection of higher-order beam theory is size-dependent and smaller than that of classical beam thory. The electromechanical coupling coefficient is enhanced a lot due to the flexoelectric effect and non-local elasticity/ surface stress.

lx.226@stu.xjtu.edu.cn

14:06–202A+B

Atomistic simulation of compression deformation behavior in magnesium single crystal

Xiaozhi Tang[†], Yafang Guo, Honggang Qi, Yuesheng Wang
Institute of Engineering Mechanics, School of Civil Engineering, Beijing Jiaotong University, Beijing, China
Molecular dynamics simulations are used to investigate the deformation mechanism of magnesium single crystal under c-axis compression. It is found that the pyramidal $\{11\bar{2}2\}$ slip dominates under compression loading, no compression twins are observed. Base on the analysis of the full pyramidal slip of $1/3$ $(\bar{1}1\bar{2}2)[\bar{1}1\bar{2}3]$ ($\pi 2$), which leaves no defect but only a slip step at the surface of the sample, we found that it is accomplished by two steps. The first step is a $\frac{1}{6}[20\bar{2}\bar{3}]$ slip, and then followed by a $\frac{1}{6}[0\bar{2}2\bar{3}]$ slip. Between these two steps, the stacking fault forms. In summary, shearing due to a successive slip of $\{11\bar{2}2\}$ planes along the $\langle11\bar{2}3\rangle$; direction is responsible for the deformation under the c-axis compression in our simulations at the nanoscale.

txz771@163.com

14:09–202A+B

A computational study on overall mechanical behavior of nanocrystalline and ultra-fine polycrystalline metals

Li Chen, Yueguang Wei[†]
LNM, Institute of Mechanics, Chinese Academy of Science, Beijing, China
Investigation on the mechanical behavior of nanocrystalline and ultra-fine polycrystalline metals accompanying by intergranular fracture has been performed. Both the finite element method which is based on the conventional theory of mechanism-based strain gradient plasticity accounting for the size effects and the mixed-mode cohesive interface model are used. Systematical studies on the overall strength and ductility of polycrystalline aggregates which depend on both grain interiors and grain boundaries for different grain sizes and different interface properties are carried out. The results have shown that the overall strength and ductility of polycrystalline aggregates with nanoscale and ultrafine grains strongly depend on the properties of the grain boundaries, and about the ductility of the nanocrystalline and ultra-fine polycrystalline metals, there is a competition of grain boundary deformation with that of grain interiors.

ywei@lnm.imech.ac.cn

14:12–202A+B

Molecular mechanics study on size-dependent electro-mechanical properties of boron nitride nanotubes

Lai Jiang[†], Wanlin Guo
Institute of Nano Science, Nanjing University of Aeronautics and Astronautics, Nanjing, China
We present an analytical study on the electro-mechanical properties of single-walled boron nitride nanotubes via a molecular mechanics model. Closed-form expressions for Young's modulus, Poisson's ratio and surface shear modulus are derived as functions of the nanotube diameter and chiral angle. Furthermore, the electric-field-induced deformation of boron nitride nanotubes is studied by this model. We predict large, size- and chirality-dependent electric-field-induced deformation, which is comparable to the density functional theory calculations.

jianglai@nuaa.edu.cn

14:15–202A+B

Mechanics of damping and energy dissipation in low-dimensional graphitic nanostructures

Dong Qian[†], Zhong Zhou
Mechanical Engineering, School of Dynamic Systems, University of Cincinnati, Cincinnati, USA
Low-dimensional graphitic nanostructures such as carbon nanotubes (CNTs) and graphene nanoplatelets (GNPs) have attracted significant attention for possible applications as reinforcement in nanocomposite, as sensors in nanoelectromechanical systems (NEMS), or as gigahertz oscillators in nanoscale device. Limited work has contributed to research on damping properties and energy dissipation of CNT/GNP, which are important for a host of applications. Motivated by the significance of this important topic, we have developed a semi-analytical approach to understand the energy dissipation mechanism in CNTs and GNPs and their relation to damping and viscoelastic properties. A characteristic time scale is reported in the dynamic response of the CNTs and GNPs through relaxation. Energy dissipation peaks (or equivalently very low Q factors) have been reported in the range of Gigahertz excitations. The underlying mechanism for such trends is discussed in the context of thermoelastic theory.

dong.qian@uc.edu

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