Composites: Part B 42 (2011) 2091–2092

Contents lists available at ScienceDirect

Composites: Part B

journal homepage: www.elsevier.com/locate/compositesb

Editorial

Preparation, Properties and Applications of Nanocomposites

Nanoscience and nanotechnology are crucial parts of the present and future of science and technology. Nanomechanics and nanocomposites are two important branches of nanoscience and nanotechnology. The 2nd International Conference on Nanomechanics & Nanocomposites (ICNN-2) was held in Beijing, China from 10–13 October, 2010 to provide a forum for the presentation and discussion of state-of-the-art achievements and future trends in nanomechanics and nanocomposites and to promote collaborations amongst the researchers in these areas. Over 200 participants from 23 countries/areas participated in and more than 180 presentations were given at the ICNN-2 conference held at the Friendship Hotel in Beijing.

Fifteen quality papers have been selected to form this special issue entitled: "*Preparation, properties and applications of nanocomposites*". The choice of this particular topic is obvious since (a) processing technology holds the key to preparation of high performance nanocomposites, (b) excellent physical and mechanical properties of nanocomposites are critical for their applications in various fields, and (c) true values of nanocomposites are only realized through their successful applications. We hope that this special issue will provide a forum for presentation and discussion of present and future developments of the subject.

One of the main aims of this special issue is to bring together independent efforts by researchers from the two disciplines of nanomechanics and nanocomposites: preparation, properties and applications into one volume. The selected papers cover a number of interesting topics: surface modification of nanomaterials as nanofillers for enhancing filler–matrix interaction and filler dispersion in nanocomposites, nanomechanics methods such as nanoindentation to determine mechanical properties of nanomaterials, effects of nanofillers on chemical, physical and mechanical properties of nanocomposites, and applications of nanomaterials as fillers for high performance fiber composites and nanocomposites as structural components for racing bikes and as novel coating for oxidation protection purposes, etc. The titles and highlights of all 15 selected papers are given below:

Paper 1:
Some Issues on Nanoindentation Method to Measure the Elastic Modulus of Particles in Composites

The application of the indentation method to measure the elastic modulus of particles embedded in a composite is theoretically investigated. Our case studies show that there exists a particle-dominated depth. If the indentation depth lies within this particle-dominated depth, the Oliver–Pharr method is able to be applied to measure the particle's elastic modulus with sufficient accuracy.

Paper 2:
Multi-Scale Investigation of Electronic Transport and Electromechanical Behavior in Carbon Nanotubes Materials

Using home-built experimental setups, electrical properties and electromechanical characterization of two systems based on multi-walled carbon nanotubes (MWNTs) were investigated at room temperature.

Paper 3:
Fabrication and Characterization of Transparent ZnO–SiO_2/Silicone Nanocomposites with Tunable Emission Colors

ZnO quantum dot-SiO_2 (Z–S) composite particles with tunable photoluminescence were obtained via hydrolyzing tetraethoxysilane in the ZnO quantum dot-containing ethanol solution. Transparent Z–S/silicone nanocomposites with tunable emission colors were then successfully fabricated by incorporating the composite particles into a transparent silicone matrix.

Paper 4:
Thermal Conductive and Electrical Properties of Polyurethane/Hyperbranched Poly(urea-urethane)-grafted Multi-walled Carbon Nanotube Composites

9–12 nm thick hyperbranched poly(urea-urethane) (HPU) shells were grafted on MWCNTs. The incorporation of HPU-MWCNTs in the PU matrix not only increased its thermal conductivity but also improved its electrical resistivity.

Paper 5:
Improving Tribological Properties of Bismaleimide Nanocomposite Filled with Carbon Nanotubes Treated by Atmospheric Pressure Filamentary Dielectric Barrier Discharge

Atmospheric pressure filamentary dielectric barrier discharge (APDBP) treatment was adopted to modify the surface of multi-walled carbon nanotubes (MWCNTs). Bismaleimide composite with APDBD treated MWCNTs exhibits a lower friction coefficient and a lower wear loss rate than the composite with original MWCNTs, which can be related to the better interfacial adhesion.

Paper 6:
Overall Behavior and Microstructural Deformation of R-CNT/Polymer Composites

A 2D plane strain model of a R-CNT composite is presented to investigate its micro-deformation and effective stiffness. R-CNT composites have better effective properties than randomly dispersed

1359-8368/$ - see front matter
doi:10.1016/j.compositesb.2011.05.001

CNT composites because of the continuous load transfer ability of the R-CNTs. In addition, the overall properties and deformation of R-CNT composites depend strongly on the R-CNT configuration.

Paper 7:
Water-dispersible Graphene Noncovalently Functionalized with Tryptophan and its Poly(vinyl alcohol) Nanocomposite

An amino acid containing conjugated structure, tryptophan, was used to stabilize graphene sheets in water through $\pi-\pi$ stacking. With the help of tryptophan, the mechanical and thermal properties of poly(vinyl alcohol)/graphene nanocomposite was enhanced at an extremely low concentration of graphene sheets.

Paper 8:
Cytotoxicity of Titanium Dioxide Nanoparticles Differs in Four Liver Cells from Human and Rat

Titanium dioxide nanoparticles can induce cytotoxicity of liver cells in a dosage-dependent and time-dependent manner, which was associated with the changes of cell viability and cell morphology, increased intercellular reactive oxygen species levels, and decreased intracellular glutathione levels.

Paper 9:
Evaluation on the Thermal and Mechanical Properties of HNT-toughened Epoxy/Carbon Fibre Composites

Use of the halloysite nanotube toughened epoxy as the matrix for continuous carbon fiber epoxy composites was reported. The positive results obtained in this paper has proven that the rigid inorganic nanotubes may be a candidate which can toughen brittle resins, leading to higher toughness without scarifying other important mechanical properties, such as modulus, tensile strength and thermal stability.

Paper 10:
Carbon Nanotubes as Structural Material and its Application in Composites

Major and most promising application of carbon nanotube is as filler in composites. The importance of nanotube's macro- and microstructure and surface treatment for bringing out its characteristics in actual composite application is emphasized, and actual nanotube composites such as plastic gears and Mg alloy bolts are introduced.

Paper 11:
A Carbon Nanotube-Enhanced SiC Coating for the Oxidation Protection of C/C Composite Materials

Incorporating carbon nanotubes in SiC coating enhanced the toughness of the coating and the interfacial bonding between the coating and the substrate, and thus suppressed the coating cracking and improved the oxidation resistance of the coating on C/C.

Paper 12:
Influence of Addition of Silica Particles on Reaction-Induced Phase Separation and Properties of Epoxy/PEI Blends

The phase separation and morphology evolution process of epoxy/PEI blends could be controlled by addition of silica particles which accelerated the curing reaction of epoxy resin. And the introduction of PEI/silica nanocomposites into the epoxy could lead to great improvement of the impact strength and storage modulus.

Paper 13:
On Fracture Toughness of Nano-Particle Modified Epoxy

A systematic study on the effects of silica and rubber nano-particles on the fracture behavior of epoxy was conducted. Mode I fracture toughness values of binary silica/epoxy, binary rubber/epoxy and ternary silica/rubber/epoxy nanocomposites were obtained by compact tension tests. Microstructures before and after fracture testing were examined to understand the role of nano-particles on the toughening mechanisms.

Paper 14:
Preparation and Characterization of Transparent Al Doped ZnO/Epoxy Composite as Thermal-Insulating Coating

Transparent Al doped ZnO (AZO)/epoxy composite, as glass thermal insulation coating, was prepared by incorporation of AZO nanoparticles into a transparent epoxy matrix. The obtained AZO/epoxy composite coating showed high visible light transmittance and good thermal insulation characteristics.

Paper 15:
A New Concept of Shock Mitigation by Impedance-Graded Materials

Using the classical theory of uniaxial stress wave propagation, it has been shown that attenuation of the stress wave energy would be possible by controlling the impedance distribution within the body of such a material; the development of such material as armor will overcome the current common difficulty of interfacial delamination failure in composite integral armor.

We thank all the plenary and invited speakers as well as all the participants for contributing to the success of the ICNN-2 conference. The conference was sponsored by the Chinese Society for Composite Materials and the Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing, China. We also express our gratitude to the financial sponsors including the National Natural Science Foundation of China and the Key Laboratory of Functional Crystals and Laser Technology, Chinese Academy of Sciences. We also thank all reviewers for their thorough assessments which ensure the high quality of the papers included in this special issue. At least two expert referees were assigned to review each manuscript. Finally, we would like to thank Elsevier Science for their support and their staff for editing of this special issue.

Shao-Yun Fu
Technical Institute of Physics and Chemistry,
Chinese Academy of Sciences,
Beijing 100190, China
E-mail address: syfu@mail.ipc.ac.cn

Yiu-Wing Mai
Centre for Advanced Materials Technology (CAMT),
School of Aerospace,
Mechanical and Mechatronic Engineering J07,
The University of Sydney, Sydney, NSW 2006, Australia

Shan-Yi Du
Centre for Composite Materials and Structures,
Harbin Institute of Technology,
Harbin 150080, China

David Hui
Department of Mechanical Engineering,
University of New Orleans,
New Orleans, USA