INTERNATIONAL CONFERENCE
ON MULTIFUNCTIONAL MATERIALS
AND STRUCTURES

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Program and Abstract Book

- Advanced Composites and their Applications
- Bio-sensors and Bio-actuators
- Bio-materials and Biomimetic
- Characterisation and Assessment
- Damage Identification and Properties / Integrity
- Intelligent Processing of Materials and Structures
- Modelling and Analysis
- Nano-materials, -sensors and -actuators
- Non-destructive Evaluation Technology
- Ocean Engineering Materials
- Optical Sensor Technology
- Structural Health Monitoring
- System Integration
- Smart Materials and Structures
- Tribology (Surface Engineering)

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The acrylic acid and silicone are common dielectric elastomer materials. These actuators have shown excellent activate properties including large strains up to 380% and high energy densities up to 3.4 J/g, high efficiency, high responsive speed, good reliability and durability, etc. When a voltage is applied on the compliant electrodes of the dielectric elastomers, the polymer shrinks along with the electric field and expands in the plain area which erects the orientation of the line. In this paper, we synthesize a novel silicone dielectric elastomer with high dielectric constant, large strain and high force output. Pre-strain and certain driving electric field are applied on the novel silicone film, respectively. The strain responding to the Maxwell stress is measured. Using the large deformation theory of finite element method to simulate the deformable behavior of materials, the simulation results agree with the experiment. The coupling effect of the mechanics and electric fields applied on the electrode of the dielectric elastomers is investigated. The finite element simulation of large deformation theory can be used to describe the dielectric elastomers materials large deformation that induced by the static electric field.

July 30 Wed 1030-1230 Session: PS (1)
Venue: TU Podium MF113
Mechanical properties of polybenzimidazole reinforced by carbon nanofibers
Li Zhang, Qing-Qing Ni, Toshiaki Natsuki
Polybenzimidazole (PBI) and vapor grown carbon nanofibers (VGNFs) nanocomposites were developed successfully by using ultrasonic mixing followed by hot compress. The contents of VGNFs used were 0.5wt%, 1wt%, 2wt% and 5wt%. The mechanical properties of neat PBI and PBI/VGNFs nanocomposites were discussed and the results were that the Young's modulus, tensile strength, storage modulus and hardness were improved after adding VGNFs. Microscopic analysis showed that the dispersion of VGNFs in nanocomposites with a lower amount was considered to be uniform.

July 30 Wed 1030-1230 Session: PS (1)
Venue: TU Podium MF114
Health Monitoring of Laminate Plates with AE Signals and Wave Propagation
Chao Du, Toshiaki Natsuki, Qing-Qing Ni
Based on Laminate plate theory, a formulation, including the effects of shear deformation and rotary inertia on the characterization of plate wave propagation, was derived. The characteristics of plate waves propagating were investigated and the influences of frequency, plate thickness and propagating direction were clearly known. A health monitoring system was built and the plate waves generated by lead break source were received by acoustic emission (AE) sensors. By the wavelet transform [1], the time-frequency domain of AE signal was derived. For a certain frequency, the first peak of the magnitude of wavelet transform indicates the arrival times of plate waves. The locations of lead break source and the delaminations of plate were compared with the predictions of theory.

July 30 Wed 1400-1600 Session: PS (4)
Venue: TU Podium MF115
Fabrication of Titania film on NiTi alloy by a deposition-assisted advanced oxidation method
A graded Titania film was formed on chemically polished NiTi shape memory alloy (SMA) by a novel deposition-assisted advanced oxidation method in a modified Fenton's reagent containing titanium tetrachloride and then characterized by SEM and XPS. The effects of the Titania film on leaching of harmful Ni ions from the NiTi substrate in simulated body fluids (SBF) is assessed by inductively-coupled plasma mass spectrometry (ICPMS). The results indicate that a thick and dense Titania film was successfully fabricated in this in situ advanced oxidation reaction assisted with an additional deposition process by the hydrolysis of titanium tetrachloride on NiTi. The Titania film can dramatically reduces Ni leaching from NiTi. XPS depth profiles show that the film possesses a smooth and graded interfacial structure that boosts mechanical stability.

July 28 Mon 1440-1500 Session: SMS (2)
Venue: Y303 MF115.2
Effects of electro-Fenton process on blood compatibility and nickel suppression of NiTi shape memory alloy
Electro-Fenton process as a modified Fenton's oxidation method in water can provide a stable hydroxyl radical (·OH) source by continuous reaction of electrochemically generated H₂O₂ with Fe²⁺ ions for surface oxidation modification of NiTi shape memory alloy (SMA). In this work, effects of electro-Fenton process on blood compatibility and nickel suppression of NiTi SMA were investigated by SEM and XPS, inductively-coupled plasma mass spectrometry (ICPMS),