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*Editorial*

# Mechanical Properties and Nondestructive Testing of Advanced Materials 2014

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The evolution of industrialization always accompanies the innovation of new materials, along with the understanding and utilization of them. Today, the advanced materials are ubiquitous in our society, spreading over in aviation, automobile, electronics, and healthcare. Advanced material is a generic term of new emerging materials, and existing materials with functional modification for specific applications, which includes but is not limited to ceramic materials, composites, metal alloys, and polymers. It is significantly necessary to comprehensively study each advanced material before being accepted by industry, especially to understand their mechanical properties that are of particular importance to the engineering aspect. Of a wide variety of testing means, nondestructive testing, such as radiation, ultrasonic, and optical measurement methods, is demonstrated to be an attractive method. Following up with the special issue "Mechanical Properties and Nondestructive Testing of Advanced Materials" published in the year of 2013, this special issue continues to demonstrate the most recent research progress in mechanical properties and the nondestructive testing of advanced materials. This special issue covers widespread topics, such as shape memory alloy (SMA), composite fiber, magnetorheological fluid, and their applications. New nondestructive testing methods are also introduced to study these advanced materials.

In the paper "Surface Effect on Diffractions of Elastic Waves and Stress Concentration near a Cluster of Cylindrical Nanoholes Arranged as Quadrate Shape," surface effect on diffractions of plane elastic waves (P-wave and SV-wave) by a cluster of cylindrical nanoholes arranged as quadrate shape was investigated based on surface elasticity theory. Its finding shows that surface effect weakens the phenomenon of dynamic stress concentration which depends not only on the surface effects, but also on the separation between holes. In "Lamb Waves in a Functionally Graded Composite Plate with Nonintegral Power Function Volume Fractions," an analytical model was established to determine the Lamb wave's propagation behavior in a thermal stress relaxation type functionally graded material (FGM) plate. This work suggests three potential methods that could be employed for nondestructive evaluation based on Lamb waves. As a review paper, "Nondestructive Detection of Valves Using Acoustic Emission Technique" discussed the principle of acoustic emission and the popular parameters analysis methods as a nondestructive way for detecting the condition and especially the defects of valves. Based on the Kirchhoff thin plate theory and the two-dimensional viscoelastic differential constitutive relation, the paper "Stability of Axially Moving Piezolaminated Viscoelastic Plate Subjected to Follower Force" presented the formulation and results for the stability of the moving viscoelastic plate with respect to the piezoelectric layer subjected to uniformly distributed tangential follower force. It mainly focused on the effects of nonconservative force, dimensionless axially moving speed, and applied voltages, which is quite useful for piezoelectric sensors and actuators. The article "Development of Miniature Stewart Platform Using TiNiCu Shape-Memory-Alloy Actuators" proposed a Stewart platform applying shape-memory-alloy as actuators,

which acts as a parallel manipulator robot to perform multiple degree of freedom actuations including three linear movements (lateral, longitudinal, and vertical) and three rotations (pitch, yaw, and roll). The operating principle was analyzed in detail in the paper.

In the paper "Vibration and Damping Analysis of Composite Fiber Reinforced Wind Blade with Viscoelastic Damping Control," the dynamic characteristics of fiber reinforced composite wind turbine blade were investigated, with a focus on viscoelastic damping treatment using layerwise theory and finite element method. Also, the relationship of the damping ratio of viscoelastic layer and determination of magnitude of composite structures was discussed. In "Nondestructive Testing of Advanced Concrete Structure during Lifetime," combined experimental approaches were applied to study hardening and drying process of concrete, and it has presented a better understanding of the relations between the lifetime cycle and the development of the mechanical properties of concrete. Considering the importance of heater power adjustment on the distribution of sheet temperature, the paper "Optimal Heater Control with Technology of Fault Tolerant for Compensating Thermoforming Preheating System" found the steady state optimum distribution of heater power by numerical optimization for obtaining the uniform distribution of temperature, and the optimization strategy with technology of fault tolerant was revealed. In the article "Numerical Simulation Procedure for Modeling TGO Crack Propagation and TGO Growth in Thermal Barrier Coatings upon Thermal-Mechanical Cycling," a thermal barrier coating material (TGO) crack propagation upon loading cycles was studied, taking account of TGO growth based on a series of finite element analyses. The analytical results show good agreements with experimental ones. Adhesive joining is pervasive while important for light-weight structures, so the article "Numerical Studies on Mechanical Behavior of Adhesive Joints" employed finite element models to accurately analyze the behavior of adhesive joints. Comparisons were performed with different modeling approaches as well as different types of element combinations, and their merits were clearly demonstrated. The paper "Optimum Design for Mechanical Structures and Material Properties of the Dual-Elbow-Bar Mechanism" used ADAMS software to simulate and analyze the kinematical form of optimized conjugate cam-driven mechanism design for improving the overall performance of the machining.

Due to the compressive strength of warm and ice-rich frozen silt being sensitive to temperature, "Compressive Mechanical Properties and Micromechanical Characteristics of Warm and Ice-Rich Frozen Silt" employed real-time computerized tomography to assess the inner structure propagation of the warm and ice-rich frozen silt. The effect of true stress and the density damage to load were discussed in the paper. The paper "Analysis of Influence of Temperature on Magnetorheological Fluid and Transmission Performance" focused on the influence of different temperatures on the viscosity of magnetorheological fluid and its transmission characteristics. Some significant results are shown in the paper which is helpful in practical applications of MR fluid.

In summary, a broad range of topics relating to the mechanical properties and nondestructive testing of advanced materials have been collected and presented in this special issue, including both theoretical models and experimental testing methods. These works are expected to be of great interest to scholars in this field.

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