

EDITORIAL

Smart Composite Materials: Selected Papers from the International Conference on Multifunctional Materials and Structures (MFMS 08) (Hong Kong, 28–31 July 2008)

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Recently, the development of smart materials and structures (SMS), at the levels of micro and nanoscale, has grown rapidly due to the requirement of an increasing safety margin of all infrastructure, biomedical and engineering (automotive, aerospace and marine) elements. The name ‘smart’ means that a structure (or a material) should be able to respond to environmental changes or external impacts to keep it in a safe condition, without substantially changing its original functionalities. Embedding sensor and actuator technology is one of the most popular topics of all SMS disciplines, because these sensors and actuators are very small and do not influence the mechanical, thermal and geometrical properties of the host structures. Ideally, these sensors and actuators are also connected to the central system (commonly called the ‘brain’) to analyze the condition and control the necessary reaction of the structures.

Recent research on SMS has been mainly focused on embedding tiny sensors and actuators into advanced composite materials. The main reason is because advanced composites have been widely adopted for building large live-concerned structures, like airplanes (both Airbus A380 and Boeing 787). A large portion of their structures are made by carbon and glass fiber composites. Most of the rotor blades of helicopters are also made of advanced composites in order to reduce their weight and keep sufficient strength to maintain their stiffness. However, these structures are subject to many uncertain influences, such as excitation by unpredictable incoming wind with a frequency close to the natural frequency of the structures, for example, blade–vortex interaction. As a result, abnormal vibration and noise may be induced that is severely harmful to the structures. In this special issue, several types of smart materials and devices that are used for ensuring the safety of structures are introduced. It includes: piezoelectric sensors and actuators, nanoconductive particles, shape memory alloys and magneto-rheological elastomers for advanced composite applications.

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