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## Smart Building and Construction Materials

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## Editorial

# Smart Building and Construction Materials

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Advances and innovations in materials science and engineering have always played a substantial role in civil engineering, building structural design, and construction. In recent years, extensive effort has been devoted to the applications of stimuli-responsive smart materials and nanostructures in buildings. These smart materials used in the built environment can be defined as those offering specific functional and adaptable properties in response to thermal, optical, structural, and environmental stimuli. Not only do these materials enhance the overall performance of new building construction but also promise safer structures, longer durability of building elements, efficient building energy savings, greater environmental sustainability, and even higher indoor user comfort. Given the increasing imperatives for the above, we have organized this themed special issue that focuses on smart buildings and construction materials. The main aim of this special issue is to encapsulate the current interest and state of research related to the smart materials in building and construction applications, underpinning current and future challenges in building energy, environmental sustainability, and structural safety and durability.

In this special issue, after rigorous peer-review processes, the original research papers and review papers accepted cover a wide range of topics that address the critical issues in the development and implementation of smart materials for building design and construction. A total of ten papers in this special issue are listed as follows.

In the article titled, “Applications of Shape Memory Polymers in Kinetic Buildings,” J. Li et al. investigated the

structures and systems and focused on the mechanisms and behaviors of two-way shape memory effects. Special emphasis was on the potential use of the reversible shape-changing abilities of dynamic envelope structures for building energy efficiency.

S. Hao et al. proposed a heat recovery wall system composed of high thermal mass materials and air cavities which can efficiently recover gas heat from heating stoves and reduce users’ exposure to indoor air pollution. They conducted on-site experimental tests to investigate the surface temperature distribution and thermal performance of this specific wall system design.

J. Li et al. examined modular prefabricated buildings with steel structural systems and integrated building envelopes using computational simulations and experimental tests. Their results highlighted the environmental performance of each construction detail and possibilities of optimizing the design of integrated envelopes for environmental sustainability.

S. Antony et al. carried out numerical analysis to study the correlation of delamination onset and investigated the methods to enhance delamination strength of unidirectional pultruded smart composite platforms.

C. Kang et al. evaluated the self-healing performance of concrete containing fly ash and fiber for improving healing performance, by comparing the flexural load and the flexural stiffness before and after crack, using the notched specimen.

S. P. Dunuweera and R. M. G. Rajapakse reviewed the manufacturing processes, mechanical properties, typical uses, and associated environmental emissions of different

types of cement products used in civil and building environment.

R. Zhong et al. developed an optical-fiber-based thermal integrity profiling (TIP) method to provide a comprehensive and accurate evaluation of the defects inside of concrete. The proposed method was compared to the current thermal infrared probe or embedded thermal sensor-based TIP and showed better determination of defect location and size.

N. Shaheen et al. presented data on use of limestone powder as a carrier medium to immobilize *Bacillus subtilis* and its contribution to self-healing efficiency of cementitious materials in terms of recovery of compressive strength.

I. -H. Yang et al. performed experimental tests to study the flexural responses of high-strength fiber-reinforced concrete beams and high-strength concrete beams. Crack and failure patterns, load capacity, deflection, crack stiffness, ductility, and flexural toughness were compared and investigated.

Y. J. O. Moraes et al. presented results on a passive vibration control system with superelastic shape memory alloy coil springs configuration and evaluated the performance of the proposed system through analytical, numerical, and experimental methods.

This special issue not only is providing the most up-to-date information on focused areas of smart building materials, utilizing advanced materials science, but also intended to serve as an informative tutorial for nontechnical specialists from fields of architectural engineering, civil engineering, materials science, chemistry, computer simulation, and environmental engineering. It will shed new light on the various new strategies adopted for building design, structural engineering, and construction. Both undergraduate and graduate students will find this special issue a valuable reference for their special research projects and thesis works. We hope these articles will provide timely and useful information for the progress of advanced materials applications in smart buildings.

## **Conflicts of Interest**

We, the Guest Editorial team of this special issue, declare that there are no conflicts of interest or private agreements with companies regarding our work for this special issue. We have no financial relationships through employment, consultancies, and either stock ownership or honoraria, with the industry.

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