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*Editorial*

# Polymer-Based Construction Materials for Civil Engineering

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For several decades, numerous studies on the development of polymer-based construction materials for civil engineering applications have been conducted. In recent years, the polymer-based materials are mainly classified into three groups: (1) synthetic fiber-reinforced (cement) composites (FRC), (2) fiber-reinforced polymer (FRP), and (3) polymer concrete. The FRC includes several types of discontinuous fibers made of polypropylene, polyethylene, polyvinyl alcohol, polyester, and so on. It can be effectively adopted for civil structures and buildings to improve postcracking tensile performance, plastic shrinkage crack resistance, fire resistance (preventing spalling), and durability of concrete. In addition, several types of FRPs, that is, FRP reinforcing bar, FRP sheet, and sprayed FRP, have been studied for reinforcing and strengthening civil structures. In spite of their many advantages such as a noncorrosive nature, high specific strength, and electromagnetic neutrality, due to some drawbacks of FRPs, such as high brittleness, poor fire resistance, weak bond characteristics, and excessive creep, their wider practical applications have not occurred. Lastly, a polymer concrete has recently gained attention from engineers to achieve excellent mechanical properties and durability.

Several numbers of experimental and numerical papers addressed new research findings with regard to FRP strengthening systems. Y. Lu et al. investigated the effects of moisture on the initial and long-term bond behavior between a carbon fiber-reinforced polymer (CFRP) and a wet concrete with a water content of 4.73%. They found an important finding that the CFRP and concrete interface under moisture condition increased during the first few months and then decreased or fluctuated over time in terms of the shear strength and slip capacity. The models suggested by the authors well predicted the interfacial fracture energy and ultimate load of specimens. J.-Y. Lee et al. evaluated the effects of CFRP sheet, steel fiber content, and amount of shear reinforcement on the blast resistance and residual flexural performance of blast-damaged reinforced concrete beams. Using small-diameter steel bars for stirrups with small spacing could decrease the local damages more effectively than the large-diameter steel reinforcement. CFRP retrofitting showed insignificant enhancement in ductility of damaged specimens, but it distributed the blast load and protected debris scattering. Steel fibers resulted in increased ductility and enhanced blast resistance against local damages. Therefore, it can be concluded that replacing a damaged concrete cover with steel fiber-reinforced cement composites is adequate for repairing the blast-damaged RC members. J. Slaitas et al. studied a prediction model of crack width and load-carrying capacity of RC beams strengthened with FRP, based on fracture mechanics of solids. Since, at the ultimate stage of crack propagation, the load-carrying capacity of the element is achieved, the load capacity could also be estimated according to the ultimate crack depth. Based on a comparison of experimental and numerical results, the proposed analytical crack model can be considered to be used for more precise predictions of flexural crack propagation and load-carrying capacity.

A novel polymer-based repairing system for RC structures has been developed by T. Abe et al. They particularly adopted a novel polymer repairing system for enhancing fatigue resistance of RC slabs. In the repair method, two types of adhesives, i.e., a penetrable adhesive and a high-durability adhesive, were applied, and the fatigue resistance of repaired RC slabs was evaluated using wheel load running tests. The repair method proposed provided significantly better fatigue resistance than the conventional construction method, and this study thus proposed two wet repair cycles and one dry repair cycle with reinforcement measures to improve the load-bearing performance.

Discontinuous polymeric fibers were also considered for enhancing the mechanical properties of concrete by T.-F. Yuan et al. They investigated the effects of polyethylene (PE) and steel fibers on the compressive and flexural performance of no-slump high-strength concrete (HSC) and reported that the hybrid use of steel and short PE fibers in the no-slump HSC was most effective in improving the compressive and flexural strengths, energy absorption capacity, and fiber synergy.

Lastly, H.-S. Jung et al. have conducted experimental and numerical studies on evaluating the feasibility of using concrete-filled steel tube (CFT) columns from Korean Building Code (KBC2016). They adopted a high-strength steel with a yield strength of 800 MPa and a steel fiber-reinforced high-strength concrete and reported that due to the relatively large contribution of steel to strength, a filled concrete did not to bring any significant changes of strength and strain. In addition, the maximum strain of a core concrete increased and became larger than that of the steel tube as 100 MPa concrete and steel fibers were used. The maximum permissible width-to-thickness ratio of CFT was found to decrease as the concrete strength increased and increased after steel fiber reinforcement.

We hope that readers of this special issue can obtain useful experimental and numerical results and discover recent research trends with regard to polymer-based construction materials for civil engineering. Hopefully, their academic curiosities and difficulties can also be solved by the valuable research results in this special issue.

## Conflicts of Interest

The editors declare that they have no conflicts of interest regarding the publication of this special issue.

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