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Editorial: Fabrication and properties of concrete containing industrial waste

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Editorial on the Research Topic
Fabrication and properties of concrete containing industrial waste

Introduction

As the most widely used building construction material, concrete has high strength, high elasticity modulus, good plasticity and excellent workability (Lv et al., 2021). However, the traditional concrete consumes a large quantity of cements and natural aggregates, leading to high consumption of energy and resource, and even serious environmental issues (Kim et al., 2018). Besides, the manufacture of Portland cement consumes approximately 12–15% of the total industrial energy and produces about 7–8% of the total CO_2 emission in the world. So far, environmental friendly concretes, such as geopolymer concrete, waste rubber concrete, recycled aggregate concrete, and concrete containing mineral and domestic waste materials have been extensively explored and utilized. These new concretes could offer many benefits and advantages over conventional concretes in terms of energy conservation and environment protection.

This special issue "*Fabrication and properties of concrete containing industrial waste*" aims to reflect the current state-of-the-art and new developments of these environmental friendly concretes. This special issue gathers six original research and review articles that investigate and introduce the development of concretes produced with many kinds of waste materials, as well as the properties and application of environmentally friendly concretes.

Overview of this special issue

During the manufacture of the marble aggregates, a large number of marble powders are usually generated, which causes environmental problems. The performance of waste marble powder as a partial replacement for cement was examined by Memduh et al. (2022), with the aim to obtain an environmental concrete. The experimental results in this study showed that the

marble waste powder below 10% of binder can be utilized as a replacement for cement to effectively improve the capacity of concrete beams.

Using waste molecular sieves instead of sand as water-absorbing fine aggregates in cement-based materials can effectively deal with factory adsorption waste and reduce sand consumption. Shi et al. (2022) studied the effect of the molecular sieve as a hydration internal curing agent on the performance of cement-based materials. Their results showed that, when 10% of sand was replaced by a molecular sieve under the same total water content, the compressive and flexural strengths were increased by 5% and 10%, respectively, and the drying shrinkage was reduced by 6%.

Globally, coal gangue is mainly landfilled due to the lack of effective utilization technology. It not only occupies lots of lands but also causes severe environmental pollution. In the study conducted by Jiu et al. (2022), a cementitious material was prepared by combing the metakaolin and cement, and its mechanical properties and hydration products were analyzed. They reported that the preparation of low-carbon cementitious materials by activating gangue *via* suspension calcination provides a new method for gangue utilization and carbon emission reduction during cement production.

Ding et al. (2022)studied the effects of air-entraining agent (AEA) and polypropylene fiber (PPF) on the autogenous shrinkage and fracture properties of fully recycled aggregate concrete (FRAC), aiming to obtain a FRAC with a low density, low autogenous shrinkage, and superior fracture properties. They revealed that AEA can slightly reduce density and it has an adverse effect on the strength and fracture properties of FRAC. In addition, they reported that the incorporation of PPFs can reduce the adverse effect of AEA on compressive strength and splitting tensile strength, and it increased the adverse effect on fracture properties.

Shotcrete is widely used in tunnel lining, slope support, coal mine roadway and other concrete projects. Adding fiber into shotcrete would greatly improve the performance of shotcrete. Liu et al. (2022) overviewed the effects of basalt fiber addition on performance of shotcrete. Their overview showed that compared with traditional plain shotcrete and steel fiber shotcrete, shotcrete incorporated with basalt fiber can dramatically improve the bending resistance, toughness and durability, therefore effectively improving the engineering performance of concrete structure, such as lining support. Besides, they focused on the engineering performance improvement and enhancement mechanisms of basalt fiber as an admixture into shotcrete in their work.

An accurate evaluation of the mechanical properties and service status of wet concrete is closely related to the reliable design and safe operation of concrete structures, e.g., hydraulics, marine engineering, bridges, and tunnels, etc. To promote the application of new and high-performance concrete in complex water environments, the research progress on the service performance of concrete in water environments was reviewed by Wang et al. (2022). They mainly summarized and analyzed the influence of water content, water pressure, and loading rate on the static and dynamic characteristics of concrete in complex water environments.

Conclusions

In this special issue, six papers were collected about the *Fabrication and properties of concrete containing industrial waste* as well as the development of many kinds of environmentally friendly concrete. They are the state-of the-art researches, aiming at providing fundamental innovations in the development of *Fabrication and properties of concrete containing industrial waste* as well as the development of many kinds of environmentally friendly concrete.

Author contributions

LW: writing-original draft and preparation. PZ: review and supervision. GG: review. JG: editing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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