Editorial

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The production of Portland cement is a process with significant energy consumption and carbon dioxide emission. In recent years, there has been a considerable amount of research on reducing the environmental impact of the concrete industry by means of partially replacing cement with by-products from other industries, or developing new materials with a higher durability performance and longer service life. The first two papers in this issue of *Advances in Cement Research* respectively address the use of belite cement and blended cement using metakaolin and hydrated lime as alternative cements, with a common goal of reducing their carbon footprint. Zhao *et al.* (2015b) address the possibility of enhancing the early-age hydration of belite by combining it with strontium oxide, sodium oxide and potassium oxide. The study focuses on the effect of adding these three oxides (or a combination thereof) on the burnability and phase composition of belite. The results indicate that the total hydration heat release is increased with the addition of all three elements, with the addition of strontium oxide yielding the highest heat release. Ismael and Ghanim (2015) investigate fresh and hardened properties of blended cements that contain metakaolin or a combination of metakaolin and hydrated lime. An optimum mix of 22% by weight of cement replacement (12% metakaolin and 10% hydrated lime) produces a blend with a reduced setting time and almost the same compressive strength in comparison to a control mix without cement replacement.

The next two papers in this issue study the effect of admixtures in improving water retention capacity and workability of the freshly mixed materials. Liang *et al.* (2015) investigate the influence of alkaline sulfate on the workability retention of cement paste that contains polycarboxylate superplasticiser (PCE). The authors found the presence of alkaline sulfate has a lower impact on the setting time and compressive strength when the cement paste contains PCE with a long side chain. Liu *et al.* (2015) explore the use of a complex admixture that results from intercalating glucose with raw bentonite (G-Ben) as a low-cost water-retention admixture. The experimental results indicate that the water retention is higher than 94% without a decline in the compressive strength. With an optimum glucose mass ratio of 4–7% in G-Ben, it is observed that the retardation effect of glucose in cement hydration is inhibited while it plays its role in water retention.

The search for repair materials with enhanced durability and a longer lifetime as well as self-healing properties has led to the introduction of polymers in cement-based materials. In the fifth paper of this issue, Fiertak *et al.* (2015) investigate the suscept-

ibility of polymer–cement composites to biocorrosion due to mould fungi. Polymer-modified mortars were found to be more susceptible to a high growth of fungi than cement mortars. The high growth of these microorganisms increases the moisture content and absorption capacity of these systems. Experimental observations indicate that the action of fungi has two opposing effects: unsealing of the material due to biocorrosion, and deposition of calcium carbonate and corrosion products in pores and microcracks.

Lu *et al.* (2015) conduct an experimental study of the thermal conductivity and setting time of inorganic solidified foam (ISF), which is a foam cement-based material used to control and extinguish coal fires. From the experimental results, the authors relate the thermal conductivity of ISF to the aqueous foam volume and develop an index to describe quantitatively the flow of this material. By developing this index, termed LFT or loss of fluidity time, and its measurement, the authors develop a methodology to quantify the setting properties of ISF.

In the study of cement-based materials, the use of experimental techniques is needed to characterise their chemical, physical and mechanical properties. A commonly used technique to characterise crystalline materials and their chemical composition is X-ray powder diffraction. The last paper in this issue (Zhao *et al.*, 2015a) investigates the influence of particle size distribution of an artificial tetracalcium aluminoferrite–aluminium oxide on the accuracy of X-ray quantitative analysis using the reference intensity ratio and the Rietveld methods. The results, supported by synchrotron radiation analysis, indicate that both approaches can perform an accurate analysis when at least 95% of the particles range between 1 and 5 μm .

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