Editorial

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Cement research continues to be a diverse field, encompassing aspects of the physical sciences, environmental sciences and engineering. The broad diversity of the field is reflected in the publications within this issue of *Advances in Cement Research*. Equally, the global relevance of cement science continues to be reflected in the spread of nationalities of this issue's authors.

However, there remain a number of key themes of relevance to industry, academia and indeed society as a whole. Sustainability, in terms of reduced environmental footprint and improved durability is one of society's key drivers. Cement and concrete are, despite the popular misconception, low carbon materials. The embodied carbon associated with concrete may often be considerably lower than other construction materials (Purnell, 2012). Whilst there may be a number of alternatives to Portland cement based concrete, as reviewed in this journal by Sharp *et al.* (2010), the drive to reduce the environmental footprint yet further occupies many.

Three of the seven papers in this issue concern the use of cement replacement materials (CRMs), both conventional (pfa, ggbs) (Hocine *et al.*, 2012) and less so (Amin *et al.*, 2012; Barauskas and Kaminskas, 2012). The paper by Amin *et al.* (2012) continues work looking at the activation of non-conventional CRMs. Where previous studies have considered pozzolans of biological origin, e.g. bagasse ash (Amin *et al.*, 2011), the paper here considers the chemical, mechanical and thermal activation of clays, showing that clinker replacement up to 30% is possible with mechanically and thermally activated clays. Barauskas and Kaminskas (2012) meanwhile also looked at the addition of a natural pozzolan, this time in conjunction with limestone, and its impact on hydration in a chloride environment. Amongst other things, they have shown that a combination of natural pozzolan and limestone may reduce the ingress of chlorides into cement samples, offering potential improvements in concrete durability. In this instance, chloride migration was inhibited by being chemically bound. In the second of the papers in this issue concerned with the use of CRMs, Hocine *et al.* (2012) have measured the zeta potential of various systems, including a limestone cement (CEM II/B – LL) and a composite cement containing both pfa and ggbs (CEM V/A (S-V)), and found that the zeta potential is pretty much independent of the type of binder.

Whilst ostensibly on a very different topic, the paper by Ltifi *et al.* (2012) is related to those already mentioned in that it attempts to improve the technical performance of concrete, this time by

the use of a cost-effective chemical admixture. Furthermore, just as mineral admixtures can reduce the carbon footprint of concrete, chemical admixtures can achieve the same (Purnell and Black, 2012). The use of sodium tripolyphosphate has been shown to improve the rheological properties of cement pastes for a short period, whilst also acting as a retarder. Interestingly, the salt was also found to inhibit the corrosion of a steel bar, albeit *ex situ*, possibly offering improved durability of reinforced concrete.

Returning to the earlier theme of sustainability, Portland cement has often found application as a means for the immobilisation of waste, either by solidification/stabilisation in a cement matrix (Jantzen *et al.*, 2010), or by the use of waste materials within the raw meal during cement manufacture (Herfort *et al.*, 2010). Two of the papers in this issue deal with similar issues. Karagiannis and Ftikos (2012) have looked at the use of refuse derived fuel (RDF) and its impact on the composition of clinker. The use of such a fuel, with minimal impact on clinker composition, enables the embodied carbon of cement clinker to be reduced yet further, thus also reducing the carbon footprint of concrete. In the second paper concerning the incorporation of foreign elements into clinker phases, Wang *et al.* (2012a) have looked at the effect of strontium dioxide on the structure and hydration behaviour of tricalcium silicate. The addition of small quantities of strontium dioxide encouraged alite formation and led to increased reactivity.

The remaining paper in this issue of *Advances in Cement Research* shows the broad nature of cement research, moving away from cement as simply a construction material and looking to develop it as a smart material, being responsive to its environment (Wang *et al.*, 2012b). They have added small quantities of carbon fibre to a sulphoaluminate cement and observed a change in its capacitance upon changes in temperature. The percentage change in capacitance was most pronounced at just 0.5% fibre mass fraction, offering the potential for carbon fibre cement composites with intrinsic temperature sensing properties.

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