Editorial

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With increasing pressures on the cement industry to comply with strict environmental regulations and also to manage the dwindling raw material sources, there has been a noticeable reduction in the clinker factor worldwide. The move towards increased use of supplementary cementing materials is also beneficial from the economic and durability point of view. However, the successful utilisation of these additives in concrete is hampered by a lack of information about the mechanisms of performance of such materials when used in combination with cement. The emphasis in current research is on bridging this gap, particularly in the understanding of the chemistry of cementitious blends.

The understanding of cement chemistry has grown leaps and bounds in the past decades owing to the use of several microanalytical techniques that have traditionally been in the realm of chemistry and materials science. As the applications of such techniques to the study of cementitious materials continue to grow, we have been able to unravel the structure and distribution of hydration products, which has in turn helped to explain fundamental properties of these materials. The set of six papers in this issue address diverse aspects of cement hydration in the presence of additive materials with the help of various microanalytical techniques.

Quantification of hydration products is tricky, especially for compounds that are present in small quantities such as ettringite. The first paper looks at the assessment of the quantity of ettringite forming in high-alite cements in mixtures with fly ash and coal gangue (Tao and Yumei, 2015). The ettringite was extracted from the cementitious paste using a solvent mixture of ethylene glycol and methanol. After extraction, the quantification was performed using X-ray diffraction.

The influence of silica fume and fly ash on the pore structure in cementitious pastes at low water to binder ratios is investigated in the next paper (Zhao and Sun, 2015). With a combination of mercury intrusion porosimetry and microstructural evaluation, the authors were able to conclude the beneficial role of silica fume in improving the pore structure. Additionally, the authors also found that the use of fly ash in steam cured low water-to-binder concrete had a positive impact on the pore structure.

As naturally available resources for the manufacture of the cement dwindle, there is a constant effort in the industry to identify alternative materials. One such candidate is phosphogypsum, which is a by-product of phosphoric acid production, and has been in use for ordinary Portland cement manufacture for

quite some time now. In the third paper, the authors look at the possibility of utilising phosphogypsum for calcium sulfoaluminate cements (Shen and Qian, 2015). The fundamental differences between the hydration characteristics in systems involving phosphogypsum and natural gypsum are explored in the paper with the help of X-ray diffraction, heat flow measurements and analysis of chemically combined water.

The fourth paper in the issue deals with the use of potassium polyacrylamide as an additive in oil well cement slurry (Li *et al.*, 2015). The alterations in microstructure are studied after using liquid nitrogen and vacuum drying to stop hydration and preserve the structure at different ages.

The multidimensional nature of sulfate attack is explored by the authors in the next paper, which is a state-of-the-art review (Whittaker and Black, 2015). Specifically, the influence of the binder, the type of sulfate, and the difference between field and laboratory studies are explored.

Blended cements are typically manufactured by intergrinding the ingredients; very often, the differences in hardness of the constituents leads to a variably ground product (Vizcaino Andrés *et al.*, 2015). The final paper is an experimental study to determine the influence of fineness of the various components in blends involving clinker, calcined clay and limestone. The performance of the blends was measured using heat of hydration studies, along with compressive strength and pore structure development. The clinker fineness was seen to play the most important role; the effect of clay fineness was also significant.

We hope you will find the papers in this issues interesting, and will certainly be able to appreciate the nuances of cement hydration that have been brought forth by the use of combined micro-analytical techniques.

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