

Editorial

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The field of civil engineering has grown to be very demanding with respect to construction materials performance, ranging from requirements for special properties in the early and final stages, to production of materials which are environmentally friendly as well as economical. The composition and properties of the binders and admixtures are perhaps the most important components in the tool box which need to be advanced to provide this diversification. This is a continuous challenge which calls upon state-of-the-art research to apply advanced concepts of materials science and engineering. Fundamental scientific understanding is required to be mobilised towards the engineering of binders and admixtures to deal with issues which are relevant to the civil engineering industry.

The papers in the present issue of *Advances in Cement Research* cover these aspects, being based on fundamental scientific treatment of relevant issues. They include kinetics and early age behaviour and their dependence on binder composition as well as application of secondary cementitious materials. The scientific treatments are based on modelling of hydration reactions, interactions between particles, characterisation of changes in composition and structure over time, and the microstructure developed.

Kinetics of binders within the context of characterisation and control by admixtures are covered by the first three papers in this issue. Although the papers deal with specific systems and methodology they can be useful for many other systems. Wei and Xiao (2014) characterise the hydration reactions during the first 24 hours using electrical and heat measurements and study the influence of fly ash. Modelling of the reaction rates and the influence of composition are developed, and kinetics parameters are defined and quantified. Accelerating effects are studied by Stefanoni *et al.* (2014) in the context of shotcreting technologies. The special insight in this paper is the influence of calcium carbonate aggregates, which is shown to be quite significant in enhancing acceleration, contrary to the prevailing engineering belief that aggregates are inert. In-depth study of the reactions is based on a wide range of techniques which are integrated together to provide insights into the mechanism of acceleration by the aggregates, which is largely based on ettringite formation. Retardation is studied by Pyatina *et al.* (2014) in special systems of G cements at high temperatures of between 50 and 90°C. Physical and mechanical tests are combined with characterisation of the internal structure and composition of the products developed, to provide insights of the mechanisms of the influence of the retarding admixtures.

The early age behaviour is not just a function of the hydration reactions but is affected also by interactions between particles in suspension. This aspect is covered in the paper by Tasci and Yılmaz (2014). Their study specifically addresses the influence of pozzolanic particles. Characterisation of charges, contact angle and surface energy serve to analyse the behaviour, especially in the context of water demand and setting time.

Characterisation of a variety of influences of secondary cementitious materials are the subject of two papers dealing with the composition and microstructure of mature systems. Hu *et al.* (2014) applied a range of techniques to investigate the influence of slags, correlating mechanical properties of various phases at the micro-scale characterised by nano-indentation with microstructural characteristics, to model the macroscopic elastic moduli of the composite cement. Enemark-Rasmussen *et al.* (2014) demonstrated the use of ¹⁹F MAS NMR spectroscopy to detect small amounts of fluorine ions in cementitious hydrates which could be an effective tool to resolve various characteristics of calcium silicate hydrates in complex cementitious systems.

The scope of these papers can benefit the reader not just for the specific topic of each but also from the mode of treatment of the system studied which could be relevant to other binder and admixture systems of interest.

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