Editorial

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Editorial

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The variety of papers encompassed in this April issue of *Construction Materials* illustrates the broad and fascinating diversity of just one subset of construction materials – cementitious materials. Mortars and concrete they may well be, but this issue also embraces a multiplicity of additions and varieties on these historical materials, including now familiar entities such as slag and silica fume, but also less-common (but no less interesting) array of constituents such as steel and polypropylene fibres, zeolite, residues from the leather-tanning process, and even pumice aggregate from volcanoes. Those students (as well as some more experienced professionals) who ask 'why are you researching concrete/mortar/cement, surely we know everything there is to know by now?' should be directed towards this issue, both as an example of the breadth of new and exciting research still being pursued around the world, but also as an example of the journey still to be travelled and the discoveries still to be made.

This perpetual and continual variety of on-going research highlights the challenge and scale of endeavouring to encompass the plethora of material types into a single text, a not-insignificant challenge manfully undertaken by the late Professor Per Freiesleben Hansen (1936–2002) for his newly updated and published book, *The Science of Construction Materials*, reviewed here by Sims. This book aims to facilitate the learning of the scientific principles underlying the properties, behaviour and performance of construction materials. It also helps bring together the frequently disparate disciplines of specialised material scientists and practicing civil engineers, a closer relationship of which would be of benefit to both parties.

The science behind mortars is the focus of the first paper in this issue, in particular the effect of sulfate attack on the durability of mortars produced with natural zeolite and silica fume (Canpolat, 2012). It was found that both of these cement replacements caused a significant increase in the sulfate durability of mortars, even at the highest concentrations of sulfate or magnesium (or both). It is thus shown that the inclusion of zeolite and silica fume both helped in in obtaining sulphate resistant cement, at least up to the 90 days testing conduction here.

Zeolite and silica fume are now commonplace in mortars, but the incorporation of leather-tanning by-products into mortar is definitely somewhat less common. More specifically, de Oliveira Andrade and Mattje (2012) have investigated the effect of chromium-tanned leather residue on the properties of mortar, with the residue being a widely available waste by-product of the Brazilian leather tanning industry. Its use as a sand replacement certainly has potential, as proven by the results presented here. Its use of a widely available waste material (at least locally in Brazil) is also to be applauded, although the possibility of environmental issues provoked by chromium leaching still needs to be further investigated and understood.

The third and final paper on mortars discusses properties more commonly associated with its larger aggregate brother (concrete), in particular self-compacting concrete (SCC). Self-compacting cement grout (SCCG) has been proved to be an economical and effective material used for repairing structural cracks, although it can be costly due to its high cement content. The paper presented here by Lim *et al.* (2012) describes how GGBS has been added in order to produce a self-compacting repair mortar (SCRM). They recommend a maximum of 50% replacement to enable the best development in long-term compressive strength. However, as with many cementitious materials with high fines contents, shrinkage can always be a concern and further work is therefore still necessary in this area.

As with SCCG and SCRM, all good new cements and concretes need their own acronym, a theme continued by Singh *et al.* (2012) with their hybrid fibre-reinforced concrete (HyFRC), building upon previous work on steel fibre-reinforced concrete (SFRC). They investigated the flexural fatigue strength of HyFRC containing varying proportions of steel and polypropylene fibres. Relationships between stress level, fatigue life and survival probability are determined and discussed. Equations are also presented to predict the flexural fatigue strength of HyFRC, although as with much material research, the results for now can only be used for the specimen sizes investigated for the research, with further work required to investigate different specimen and fibres types and sizes.

The final paper in this issue is focused on lightweight concrete (LWC), incorporating volcanic materials-based blended cements and pumice aggregates (Hossian, 2012). The large array of tests indicates that these materials could be successfully used for the production of LWC for structural applications, having satisfactory strength and durability characteristics. As well as beneficial structural properties, they also seem to incorporate an additional beneficial effect of reducing drying

shrinkage and water permeability, via the refinement of the concrete's pore structure and interfacial transition zone.

The mixing and production of mortars and concretes is considered by many as a manufacturing process in itself. Indeed, without manufacturing our materials or combinations of materials into a useful shape or form then the majority would not be able to be used within construction. This theme is investigated in the second book review in this issue; *Manufacturing processes for Design Professionals* by Rob Thompson, which explains how forming, cutting, joining and finishing of materials are combined together to produce an attractive and functional object.

Only by understanding the scientific principles underpinning the materials available to us however, can manufacturers take full advantage of their wide range of properties and capabilities, and it is research like that presented in this issue which continually expands the knowledge base upon which many of these scientific principles are developed and built upon, and long may it continue.

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