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Advances in characterization and modeling of cementitious materials: materials and test methods

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This issue is the second and last one on the theme of Advances in Characterization and Modeling of Cementitious Materials, and deals with novel materials and test methods. Five invited scientific articles form part of this issue, to add to the five on transport and volume changes which was part of the previous issue of this journal.

The first paper describes an experimental investigation aimed at determining the feasibility of using X-ray fluorescence (XRF) to obtain the alkali concentrations of the pore solution in cementitious systems, which enable the calculation of pore solution resistivity. Accurate determination of pore solution resistivity is crucial in predicting transport-related durability characteristics of concrete. The second paper introduces a Concrete Prism Test (CPT) Chemical Index Model to predict Class F fly ash dosages required to prevent alkali-silica reaction induced expansion in concrete. Despite a large standard error, this model presents the promise to reduce a two-year long test (CPT) to just a calculation, which is beneficial for material designers and engineers. An approach to integrate nanoindentation testing and finite element simulations to compute the fracture toughness of cementitious materials is introduced in the third paper. The paper presents how nanomechanical information can be beneficial in understanding the bulk fracture properties of cement-based materials. The development of a multi-functional ductile cementitious composite is discussed in the fourth paper of this issue. It uses microencapsulated phase change materials (PCMs), capable of reducing temperature fluctuations in the material due to their high heat of fusion. It is shown that, although addition of microencapsulated PCMs are detrimental to compressive strength, they have very little effect on the flexural strength and deflection capacity. The final paper in this issue presents several approaches for the analysis, simulation, back-calculation, and design of strain softening and strain hardening cement composite systems. The methodologies reported in this paper are expected to help in the design of structural systems made using steel and textile fiber reinforced cement composites and ultra-high performance fiber reinforced concretes.

These papers describe cutting-edge research, which we expect to be of immense use to the scientific community. It is our hope that the contributions in this issue leads to continued research and scientific contributions to this important area in cement-based materials research.

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