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Influence of the Molecular Architecture of a Polycarboxylate-Based Superplasticizer on the Rheological and Physicomechanical Properties of Cement Pastes

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Abstract : The main difficulty encountered in the formulation of high-performance concrete (HPC) consists in choosing the most efficient cement-superplasticizer pair allowing to obtain maximum water reduction, good workability of the concrete in the fresh state, and very good mechanical resistance in the hardened state. The aim of this work is to test the efficiency of three polycarboxylate ether-based superplasticizers (PCE) marketed in Algeria with CEMI 52.5 R cement and to study the effect of chemical structure of PCE on zeta potential, rheological and mechanical properties of cement pastes. The property of the polymers in cement was tested by a Malvern Zetasizer 2000 apparatus and VT 550 viscometer. Results showed that the zeta potential and its rheological properties are related to the molecular weight and the density carboxylic of PCE. The PCE with a moderate molecular weight and the highest carboxylic groups had the best dispersion (high value of zeta potential) and lowest viscosity. The effect of the chemical structure of PCEs on mechanical properties is evaluated by the formulation of cement mortar with these PCEs. The result shows that there is a correlation between the zeta potential of polymer and the compressive strength of cement paste.

Keywords : molecular weight, polycarboxylate-ether superplasticizer, rheology, zeta potential
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