INTERNAL CURING OF HIGH PERFORMANCE CONCRETE BY SUPERABSORBENT POLYMERS

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Modern high and ultra-high performance concretes (HPC) and (UHPC) are demonstrating very good mechanical properties and durability, however these properties can be compromised by early age cracking caused by autogenous shrinkage. Autogenous shrinkage is defined as the bulk deformation of a closed, isothermal, cementitious material system not subjected to external forces (Jensen and Hansen 2001a) and its main driving force is accepted to be capillary pressure. In low water-to-cement ratio (w/c) systems, water-filled capillaries are emptied during the self-dessication. Consequently capillary pressure builds up and it can cause crack development in the concrete. Capillary pressure can be reduced if extra water is provided for concrete curing. In low w/c concretes, providing the water externally is not effective because of the very fine porosity and resulting low permeability, which does not allow the water to access the whole volume of the material. To overcome this limitation, internal curing with Superabsorbent polymers (SAP) has been proposed (Jensen and Hansen 2001b; Hansen 2002). SAP are covalently cross-linked hydrophilic polyelectrolytes with three dimensional structures, capable to absorb high amounts of liquid without dissolving and retain the liquid even under a certain pressure (Buchholz and Graham 1997). They are added in the dry state during mixing, whereupon they rapidly absorb part of the mixing water and form water-filled cavities (about 100-500 μm in diameter) in the fresh concrete (Hansen 2002; Mechtherine and Reinhardt 2012). To compensate for self-desiccation, the amount of water that will be absorbed by the SAP needs to be added to the mixing water (Jensen and Hansen 2001b). In this study two mixtures were prepared – reference mixture without SAP (w/c 0.27) and mixture with SAP addition and extra entrained water (w/c increased by 0.05). Concrete was mixed in a high shear mixer with the capacity of 75 liters. Corrugated plastic tube method was used to measure autogenous shrinkage.

References

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