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Prediction of Concrete Hydration Behavior and Cracking Tendency Based on Electrical Resistivity Measurement, Cracking Test and ANSYS Simulation

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Abstract : Hydration process, crack potential and setting time of concrete grade C30, C40 and C50 were separately monitored using non-contact electrical resistivity apparatus, a plastic ring mould and penetration resistance method respectively. The results show highest resistivity of C30 at the beginning until reaching the acceleration point when C50 accelerated and overtaken the others, and this period corresponds to its final setting time range, from resistivity derivative curve, hydration process can be divided into dissolution, induction, acceleration and deceleration periods, restrained shrinkage crack and setting time tests demonstrated the earliest cracking and setting time of C50, therefore, this method conveniently and rapidly determines the concrete's crack potential. The highest inflection time (ti), the final setting time (tf) were obtained and used with crack time in coming up with mathematical models for the prediction of concrete's cracking age for the range being considered. Finally, ANSYS numerical simulations supports the experimental findings in terms of the earliest crack age of C50 and the crack location that, highest stress concentration is always beneath the artificially introduced expansion joint of C50.

Keywords : concrete hydration, electrical resistivity, restrained shrinkage crack, ANSYS simulation
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