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Self-Healing Phenomenon Evaluation in Cementitious Matrix with Different Water/Cement Ratios and Crack Opening Age

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Abstract : Concrete elements are subject to cracking, which can be an access point for deleterious agents that can trigger pathological manifestations reducing the service life of these structures. Finding ways to minimize or eliminate the effects of this aggressive agents’ penetration, such as the sealing of these cracks, is a manner of contributing to the durability of these structures. The cementitious self-healing phenomenon can be classified in two different processes. The autogenous self-healing that can be defined as a natural process in which the sealing of this cracks occurs without the stimulation of external agents, meaning, without different materials being added to the mixture, while on the other hand, the autonomous seal-healing phenomenon depends on the insertion of a specific engineered material added to the cement matrix in order to promote its recovery. This work aims to evaluate the autogenous self-healing of concretes produced with different water/cement ratios and exposed to wet/dry cycles, considering two ages of crack openings, 3 days and 28 days. The self-healing phenomenon was evaluated using two techniques: crack healing measurement using ultrasonic waves and image analysis performed with an optical microscope. It is possible to observe that by both methods, it possible to observe the self-healing phenomenon of the cracks. For young ages of crack openings and lower water/cement ratios, the self-healing capacity is higher when compared to advanced ages of crack openings and higher water/cement ratios. Regardless of the crack opening age, these concretes were found to stabilize the self-healing processes after 80 days or 90 days.

Keywords : sealf-healing, autogenous, water/cement ratio, curing cycles, test methods
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