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Autogenous Self-Healing of Concrete: Experimental Design and Test Methods – A Review

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Abstract

Cracks in concrete structures can serve as pathways for aggressive chemical substances that can lead to a progressive deterioration of the cement stone as well as of the reinforcement, affecting the load capacity, service life and useability of concrete structures. However, concrete and reinforced concrete exhibit an intrinsic ability to heal cracks, defined as autogenous self-healing. This effect includes the precipitation of calcium carbonate in the presence of water and CO2 and is accompanied by continued hydration, swelling and mechanical blocking of the crack pathway. Experiments led to the inclusion of crack healing by autogenous self-healing in Eurocode 1992-3 for water retaining concrete structures. However, despite code restrictions, autogenous self-healing of concrete shows limited effectiveness in practice. This indicates the need for further research to provide engineers with reliable design rules. Therefore, this study aims for giving a broad literature review on the state-of-the-art knowledge on autogenous self-healing, the boundary conditions, consensus and controversy of processes and factors influencing the efficiency of autogenous self-healing. Regarding the transferability of laboratory results to real concrete constructions, materials, crack initiation techniques, experimental concepts and methods for assessing the effectiveness of autogenous self-healing are discussed and recommendations for future experiments are set.

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