

A Preliminary Study on the pH Compensation Capacity of Encapsulated Calcium hydroxide in the Simulated Concrete Pore Solution

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Abstract

The reinforced steel bar is used in the concrete structure to improve its tensile and flexural strength. In a high alkaline environment, a passive protective iron oxide film forms around the steel bar. When the pH of a concrete structure drops below 10, the protective layer is destroyed and the steel bar begins to corrode. One of the most important substances that lowers the pH of a concrete structure is chloride ion. Various research revealed that when the Cl-/OH- ratio reduces from a critical threshold, the corrosion of the steel bar is initiated. The corrosion protection can be achieved by keeping the concrete environment at a higher pH level and maintaining the passive film for a long period of time. Distribution of alkali hydroxides like Ca(OH)₂ at later ages using a slow-release technique can be used to stabilize the pH at a higher level. In this work, encapsulated macro capsules were proposed to maintain the pH at a high level for a long period where calcium hydroxide (Ca(OH)₂) is used as the active core material of the macro capsule, and the polystyrene resin is used as the coating agent. The pH compensation capacity could be achieved by the slow release of the core material during this process. The macro capsule fabrication process was done by spray drying method using custom-made tools. A preliminary study on the pH compensation ability of the encapsulated macro capsules was tested in the simulated pore solution containing chloride ion (Saturated calcium hydroxide + 3.5% of NaCl) for 80 days. The thickness of the wall and the surrounding pH level affect the releasing rate of the core material. The initial pH value of the simulated pore solution was 12.3. The preliminary analysis reveals that the addition of 3 wt% of macro capsule to the simulated pore solution can maintain the pH level of the solution at high (More than pH 10) up to 60 days in the open air. If the dosage of the macro capsules is increased, it can maintain the pore solution at a higher pH level for more than 60 days. Furthermore, this technique can be used in the concrete industry to increase the durability of the concrete.

Keywords: *pH value, concrete, macro capsules, coating, pore solution*

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