

MODELING OF THE CARBONATION REACTION OF C-S-H

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Steel corrosion resulting from carbonation is one of the primary deterioration factors in reinforced concrete structures. For the accurate estimation of carbonation progress in concrete structures, consideration must be given not only to pH changes in the pore solution but also to the decomposition of cement hydrates. In many models, only the decomposition of $\text{Ca}(\text{OH})_2$ is considered in calculating the fall in pH. However, C-S-H makes up a large part of cement hydrates. Therefore, for accurate estimation, the carbonation characteristics of C-S-H have to be investigated in detail.

In this study C-S-H is subjected to a carbonation test. A simulated pore solution consisting of synthesized C-S-H (Ca/Si ratio = 0.7–1.4) in sodium hydroxide is carbonated using atmospheres containing 0.05, 0.5, and 5.0 vol.% CO_2 gas. Based on the results of the experiments, the carbonation characteristics of C-S-H are discussed and a model of the carbonation reaction of C-S-H is constructed. In a previous study by the author, it was found that some of the C-S-H was not decomposed, especially in an atmosphere containing 0.05 vol.% CO_2 , while the pH of the solution decreased to the equilibrium value. It is thought that carbonation alters the composition of C-S-H such that the Ca/Si ratio falls. The experimental results this time suggest that the lower the CO_2 gas concentration in the atmosphere, the greater the tendency for the C-S-H (including C-S-H with a low Ca/Si ratio) to not decompose, even if the pH of the solution falls. This behavior is not seen with other cement hydrates and appears to be a phenomenon unique to C-S-H.