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A model of autogenous self healing mechanisms in concrete

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Cementitious materials present the built-in ability to self-repair small cracks. One of these autogenous self healing mechanism is based on the hydration of unhydrated cement particles in young concrete and the subsequent carbonation reactions in late-age concrete [1], eventually resulting in the precipitation of calcite on the surface of crack.

This work focuses on the physico-chemical coupling of the hydration and carbonation reactions within a multiphase and multicomponent flow model. The considered chemical reactions require both the presence of water and carbon dioxide and take into account different phase transformations, for which a porous media model is most appropriate. The reaction equations are taken in the spirit of the models due to Meier et al. [2] and Peter et al. [3].

Results of this model provide the spatio-temporal evolution of critical compounds such as porlandite, calcite and moisture, as well as of the gas phase. This information allows to build estimates of the healing capacity of the system, as well as to obtain indicators of changes in the pH that directly couple with the corrosion risk in reinforced concrete.

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