

Modeling the chloride-induced corrosion initiation of steel rebar in concrete

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Corrosion of rebar in concrete is one of the most prominent durability problems in reinforced concrete, especially where de-icing or seawater salts come into contact with the structures. Previous electrochemical and microscopic investigations have shown that local crevices between the mill scale and the underlying steel surface accelerate the corrosion initiation of rebar in concrete. Steel depassivation in concrete depends highly on the chloride-to-hydroxide ratio of the pore solution. The differential equations for the transport of hydroxide, chloride and seven other ionic species in the concrete pore solution, coupled with the electrochemical reactions on the steel surface, were numerically modeled in simulated crevices that exist between the mill scale and the steel surface using the COMSOL finite element software. The numerical results verify that the mill-scale on the surface of rebar enhances the initiation of corrosion which is also in agreement with experimental findings