EFFECT OF DAMAGE ON CHLORIDE PENETRATION PROFILES IN CONCRETE STRUCTURES

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Abstract: In the present paper a current status of development of a 3D numerical chemo-hygro-thermo-mechanical model for concrete is presented. In the model the interaction between the non-mechanical (distribution of temperature, humidity, oxygen and chloride) and mechanical properties of concrete (damage) is accounted for. The strong and weak formulation of the model and its implementation into a 3D finite element code are discussed. The formulation is restricted to the processes up to the depassivation of reinforcement. The application of the model is illustrated on one numerical example in which the transient 3D FE analysis of RC slab is carried out in order to investigate the influence of damage of concrete on the depassivation time of reinforcement. In the analysis the load free and previously loaded RC slabs are exposed to the aggressive influence of sea water. Due to external load, the loaded beam was damaged before the exposure of sea water. Consequently, its depassivation time is shorter than the depassivation time of companion beam which was load free. The reason is due to the cracking of concrete, which significantly accelerate processes that are relevant for depassivation of reinforcement. The numerical results are in good agreement with the observation from the engineering practice.

Key words: Concrete, Damage, Depassivation, Corrosion of reinforcement, Chemo-hygro-thermo-mechanical model, Microplane model, Transport processes, Finite element analysis.

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