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Chloride induced corrosion initiation in RC structures: A thermodynamic view point

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Reinforced concrete structures are susceptible to chloride induced corrosion when exposed to marine environments or to deicing salts. In situations where the chloride ion concentration at the reinforcement surface crosses the critical level, pitting corrosion is induced. Such corrosion processes are causing a great loss to structures worldwide. The present study proposes a thermodynamic approach towards understanding of chloride induced corrosion initiation in RC structures. The system state is defined by the chloride ion concentration at the surface of reinforcement, and, at any given time, system is considered to be in a state of thermodynamic non-equilibrium and yet locally stable with respect to the bifurcation that is assumed to take place when depassivation occurs (when Model 2, presented herein, is considered). However, when Model 1 is considered, the system would be in the state of thermodynamic equilibrium till the depassivation occurs. Thus, the initial conditions obtained from the Models 1 and 2 are different when the corrosion propagation is modeled using the non-equilibrium thermodynamics (exhibiting chaos). It is further shown that, even when the Model 1 is used, the corrosion initiation time can exhibit large variation depending on the system parameters and is verified by simulations using the Fick's second law of diffusion.

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The use of timber in bridges: The Brazilian program

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The use of timber in technologic bridges in Brazil started with the Emerging Timber Bridge Program in the state of São Paulo, Brazil (ETBPSP) and was started in 2001 with the main objective of research and development of new technologies for timber bridge construction. After five years of this program, eleven demonstration timber bridges were constructed in the State of São Paulo. Also eight composite timber/concrete bridges, one log timber girder bridge with transverse sawn deck, one transverse lumber prestressed timber bridge, and one transverse cellular plywood box prestressed bridge were constructed. A final objective is divulgation of the structural systems in extension courses to municipal engineers and in a complete publication of timber bridge project plans with the different structural systems. This paper describes the goals of the ETBPSP, accomplishments of the program in the first five years, information sheet for each of the bridges, and outlines some obstacles and opportunities.

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