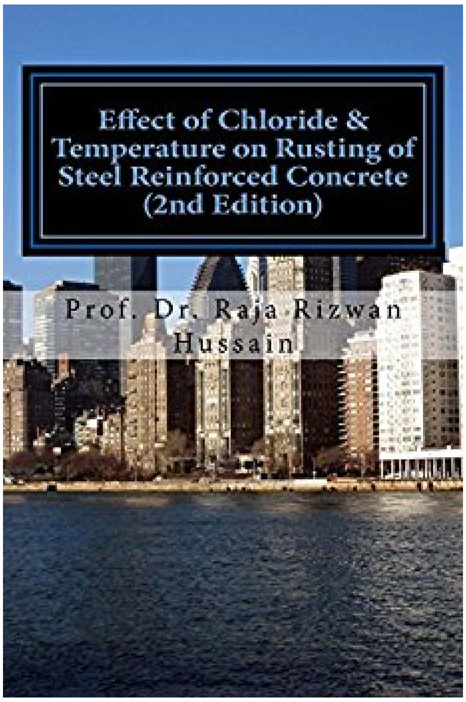
Effect Of Chloride & Temperature On Rusting Of Steel Reinforced Concrete 2nd Ed



Synopsis

Corrosion of steel reinforcement in concrete structures is a major durability problem around the world. Reinforced Concrete (RC) structures exposed to chloride and high temperature environments like sea, deicing salts, deserts and industrial zones suffer from accelerated corrosion of rebars. There is no doubt that the presence of chloride ions promote the disruption of the passive layer causing corrosion of reinforcement and the chloride attack becomes much more severe when coupled with high temperature. Therefore, to be able to forecast the service life of RC structures it is necessary to quantify the amount of corrosion. The chloride attack and increase in the electrochemical reaction rate of corrosion due to high temperature is an electrochemical thermodynamic phenomenon influenced by several factors and some of them are being overlooked in the past research works and have difference in opinion. Also it was found that the experimental data for the coupled effect of chloride and temperature on corrosion of reinforcement especially in the high temperature range and high chloride concentration is limited.The objective of this book is therefore, to investigate the effects of coupling chloride and temperature on corrosion of reinforcement throughout the life of concrete structures by incorporating realistic electrochemical-thermodynamic models and actual field condition experimentation. The modeling task has been accomplished by the use of a concrete durability model developed by our research group (Concrete Laboratory, University of Tokyo) as a computational platform on which the corrosion based reinforced concrete performance and quality throughout the life of concrete structure is examined in both space and time domains under environmental actions of chloride and high temperature. In this thermodynamic approach, reinforced concrete is treated as a composite material consisting of growing micro-scale pores in geometry, which governs basic mechanical and physical features of concrete with respect to long-term durability. On this line, the electrochemical-thermodynamic modeling of concrete forms the fundamental core of the theoretical approach to achieve both the scientific knowledge and engineering simulations of altering materials. The experimental results for the effect of chloride and temperature on corrosion have been compared with the thermodynamic corrosion model and are found to be in close agreement.In the light of experimental results, the behavior of RC corrosion is found to increase non-linearly with the increase in chloride content and temperature. The half-cell potential values are found to randomly increase and decrease in a non-uniform manner due to the destruction and reformation of passive layer by localized attack of chloride on the passive layer and increased rate of reaction at high temperature as a function of time. The rate of corrosion from 20Â C to 40Â C temperature is found to be more than from 40Â C to 60Â C temperature range because of the decrease of solubility of

oxygen in the pore water at high temperature range. Finally, the specimens were broken and gravimetric corrosion weight loss was determined experimentally and modeled analytically.

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