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Finite element analysis of influence factors on electrochemical chloride removal from concrete (1)

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Abstract

Many researchers have done a large number of studies on electrochemical chloride removal, but those are mostly based on experience datum. Recently, some mathematical models on electrochemical chloride removal have been presented, but they are generally modeled by MATLAB. To avoid the difficulty of programming finite element composition by MATLAB and also to model the whole process of ECR more visually and more efficiently, this paper presents a two-dimensional finite element model of electrochemical chloride removal from concrete using COMSOL Multiphysics program. The influence factors of chloride binding, water cement ratio, externally applied current density, thickness of concrete cover and initial concentration of chloride in pore solution are analyzed. Moreover, the relationship figures of chloride removal efficiency and above factors are concluded, which can be used to decide the technical parameters of electrochemical chloride removal in practice.

Key words: *Electrochemical chloride removal, Chloride binding, Water cement ratio, Applied current density, Thickness of concrete cover, Chloride initial concentration, Chloride removal efficiency*

1. Introduction

Chloride-induced corrosion of reinforcing steel in concrete has become the most serious disaster and is the most significant scientific and technical study for reinforced concrete structures. Plenty of methods on how to deal with chloride-induced corrosion appear in recent years, the popular two of which are the methods of cathode protection and electrochemical chloride removal. Electrochemical chloride removal (ECR) applies a high DC current density through the concrete cover between the cathode on reinforcing steel and an external anode in a suitable electrolyte to remove the chloride from the concrete by electro-migration in a short time and make the reinforcing steel repassivate. Compared with cathode protection method, ECR is a more economical and effective method, although its application is limited in the situation in which the surface domain of reinforced steel are not corroded so evidently by chloride.

Many researchers have done many studies on electrochemical chloride removal, but the studies are mostly based on experience datum. At present, some

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