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Electrochemical chloride removal for reinforced concrete with steel rebar cage using auxiliary electrodes

W. Yeih[1] , J.J. Chang[1,*], C.C. Chang[1], K.L. Chen[1], M. C. Chi[2]
1:Department of Harbor and River Engineering, National Taiwan Ocean University, Keelung, 202 Taiwan
2: Department of Fire Science, WuFeng University, Chiayi County, 621 Taiwan
*: Corresponding author, e-mail:jjc@ntou.edu.tw

Abstract

In this paper, a new approach of electrochemical chloride removal (ECR) using the auxiliary electrodes was proposed and the performances of this method were investigated by experiments. Two kinds of electrode setups were investigated: the radial type and the layer type. The results showed no matter which setup was used the chloride removal percentage all exceeded 70% after 8-week treatment. The chloride enclosed by the steel rebar cage could be successfully pushed out from concrete using auxiliary electrodes. The half cell potentials of rebars after 8-week treatment were all higher than -270 mV(CSE) and the corrosion rates were lower than 0.05 mpy, it indicated that after ECR treatment the corrosion risk of rebars was low. In addition, after ECR the surface hardness was enhanced via the results of rebound strength test. The pH value of concrete was also enhanced during the ECR process.

Keywords: electrochemical chloride removal; steel rebar cage; auxiliary electrodes; corrosion

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1. Introduction

Chloride attack is one major concern for concrete deterioration, and an over review article about the durability of concrete can be found in [1]. To deal with the concrete contaminated by chloride, removing unsound concrete and recasting repair material is one alternative and adopting ECR is another. Assessments and guidelines for ECR treatment were issued following the Strategic Highways Research Program (SHRP in the USA)—such as SHRP-S-347 and SHRP-C-620, which can be downloaded from the web. In addition, the processes were the subject of several patents which formed the basis of the “Norcure” processes that have been fairly widely known and used in USA, Europe and Japan. The idea of ECR involves mounting an anode surrounded by a liquid electrolyte (usually NaOH or Na_3BO_3) on