Influence of Cement Superplasticizer on Steel Corrosion in 3.5 % NaCl Solution

Reham H. Tammam^{1,*}, A. S. Mogoda¹, Mohamed H. Gharbawy²

¹ Chemistry Department, Faculty of Science, Cairo University, Giza 12613, Egypt

² EL-Nasr Casting Iron Company, Chemistry Department, Giza, Egypt

*E-mail: reham_tammam@cu.edu.eg

doi: 10.20964/2020.09.13

Received: 28 April 2020 / Accepted: 16 June 2020 / Published: 10 August 2020

The corrosion of reinforcement steel present under different conditions namely bare steel (S_I), steel in cement mortar (S_{II}), and steel in cement mortar containing polycarboxylate superplasticizer (S_{III}) was investigated in 3.5 % sodium chloride solution using potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) techniques. The polarization results showed that the corrosion rate of steel in a mortar containing superplasticizer is much less than that of steel in mortar only or that of uncovered steel surface, i.e. the corrosion rate follows the order $S_{III} < S_{II} < S_I$. Also, the results of EIS spectra revealed that the charge transfer resistance of steel samples decreases in the order $S_{III} > S_{II} > S_I$ conforming potentiodynamic polarization results. The corrosion rate increases and consequently the charge transfer resistance decreases with increasing the immersion time for all steel specimens in sodium chloride solution. This means that the presence of cement mortar around the steel bar decreases the contact of NaCl solution with metal which occurs through the pores in the cement mortar and hence the corrosion rate of steel decreases. In the presence of the superplasticizer within the cement mortar its porosity decreases and consequently decreases the passing of NaCl solution to steel surface results in decreasing in its corrosion rate. Increasing of the superplasticizer concentration in cement mortar results in more decrease in the rate of steel corrosion in NaCl solution. Examining the steel surface through scanning electron microscopy (SEM) indicated that this surface (S_I) exhibits much damage more than that of steel in a mortar containing superplasticizer (S_{III}) when both exposed to the corrosive sodium chloride solution.

Keywords: Potentiodynamic polarization; polycarboxylate superplasticizer; cement mortar; sodium chloride; EIS; SEM.

[FULL TEXT](#)

© 2020 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).