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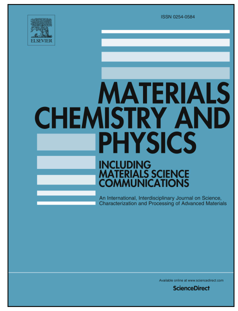

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The Efficiency of a Corrosion Inhibitor on Steel in a Simulated Concrete Environment

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Abstract

The aim of the present work was to characterize the efficiency of a corrosion inhibitor on steel in a simulated concrete pore solution. Laboratory measurements were performed at various chloride and inhibitor concentrations in order to simulate different applications of the inhibitor when used for the protection or rehabilitation of steel reinforcement in concrete. Two electrochemical techniques, i.e. potentiodynamic polarization scans and electrochemical impedance spectroscopy, were used for this study. The exposed surfaces of the steel specimens were subsequently investigated by Raman spectroscopy and scanning electron microscopy. It was found that the inhibitor can efficiently retard the corrosion of steel in a simulated concrete pore solution at concentrations of the inhibitor > 2.0 % and of chlorides < 0.3 % at a pH 10.5. On the other hand, when these conditions are not fulfilled, localized corrosion was observed. The results of the Raman and SEM/EDS analysis showed various morphologies of corrosion products and different types of corrosion attack depending on the pH of the pore solution, and the applied concentrations of the chlorides and the inhibitor.

Keywords

metals; corrosion test; electrochemical techniques; Raman spectroscopy and scattering; oxides; electron microscopy (STEM, TEM and SEM).

1. Introduction

The corrosion of steel reinforcement in concrete is one of the main reasons for the reduced service life of concrete structures [1–4], so that during the last four decades corrosion processes of steel in concrete have received considerable attention [5–8]. The corrosion of steel in concrete is related to the presence of chloride ions and carbonation, which may result in corrosion initiation as a sequence of several events [9–10].

Increasing the service life of concrete structures has stimulated the development of new technologies and materials with the aim to increase the durability of such structures [2–4]. These methods include cathodic protection, re-alkalisation, chloride extraction, and the use of corrosion inhibitors. The use of surface applied