

## Surface modification of carbon steel reinforcement of concrete

Mariela Rendón Belmonte; Miguel Martínez Madrid; José Trinidad Pérez-Quiroz; Benjamín Valdez Salas; Erick A. Juárez-Arellano; Miguel Schorr

+ Author & Article Information

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### Purpose

– The purpose of this paper was to characterize the surface of steel reinforcement of concrete under cathodic protection (CP), submerged in seawater, to understand the surface changes due to the application of CP and their consequences on cathodic current requirements.

### Design/methodology/approach

– Reinforced concrete specimens with applied CP were immersed in natural seawater. The experimental methodology included monitoring of corrosion potential ( $E_{\text{corr}}$ ); measurement of galvanic current ( $I_{\text{galv}}$ ), protection potential ( $E_{\text{protection}}$ ) and the depolarization potential of steel during the time of exposure; and electrochemical impedance spectroscopy (EIS). The chemical composition of the steel surface was assessed using X-ray diffraction (XRD).

### Findings

– The application of CP leads to the formation of a deposit on the steel surface that according to XRD results, Pourbaix diagram and physical characteristics, is a protective oxide: magnetite ( $\text{Fe}_3\text{O}_4$ ). This oxide causes a decrease in the corrosion rate and requires application of the protection current. It was found that the surface remained protected even after eight days when the CP system was interrupted.

### Research limitations/implications

– It is necessary to carry out analysis of the chemical composition of deposits formed on the steel surface, perhaps

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