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A. Montiel-García, E. Onofre Bustamante, M.L. Escudero-Rincón, E.C. De la Cruz-Terrazas, A.M. Torres-Huerta

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Study of reinforcing steel corrosion behaviour treated by bluing and cerium chemical conversion treatments, Part I: Conventional electrochemical techniques

A. Montiel-García*[1], E. Onofre Bustamante[1], M. L. Escudero-Rincón[2], E.C. De la Cruz-Terrazas[1,3] A. M. Torres-Huerta[1].

[1]Centro de Investigación en Ciencia Aplicada y Tecnología Avanzada- IPN Unidad Altamira, Altamira Tamaulipas, México.

[2]Centro Nacional de Investigaciones Metalúrgicas, CENIM-CSIC, Madrid España.

[3]CONACyT-Centro de Investigación en Ciencia Aplicada y Tecnología Avanzada- IPN Unidad Altamira, Altamira Tamaulipas, México.

***E-mail Corresponding author: edonofre73@yahoo.com.mx**

ABSTRACT

In this work, a double-layered chemical conversion coating, which consists of a bluing layer followed by a cerium oxide layer, was applied to reinforcing steel (RS) to increase its corrosion resistance under field conditions. The corrosion behaviour of the blued reinforcing steel specimens (BRS) in 3% sodium chloride with and without the top layer of cerium oxide was assessed by open-circuit potential, linear polarisation resistance, potentiodynamic polarisation curves, and electrochemical impedance spectroscopy. Scanning electron microscopy coupled with energy-dispersive spectrometry, X-ray diffraction, and atomic force microscopy were used to characterise the blued and cerium conversion layers.

The best electrochemical behaviour of RS was attained by the bluing sample sealed for 10 min in 0.001 M $CeCl_3$ (B10 + cerium chemical conversion treatments). Under these conditions, the potential shifted in the noble direction from E_{corr} to approximately 600–800 mV and the corrosion current density decreased by five orders of magnitude as compared to bare RS.

Keywords: Reinforcing steel, corrosion, bluing, cerium chemical conversion treatments.