Effect of cerium salts in the cut edge of zinc-based sacrificial coatings: influence of Al and Mg alloying elements on galvanic corrosion

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Zinc sacrificial coatings alloyed with Al and Mg for sacrificial protection of steel have been developed during the last decades and improved significantly the performance of steel against corrosion compared to pure zinc coating [1]. Despite the significant reinforcement achieved by this sacrificial coating, the cut edges or the appearance of scratches reaching the steel are the major problems due to the formation of galvanic coupling between steel and zinc-based coating. Therefore, it required supplementary active protection for galvanic coupled metallic materials.

In previous work [2], cerium chloride has been reported as a promising corrosion inhibitor on the top surface of electro-galvanized steel. Thus, this study aims at investigating the protective properties of cerium salts for the cut edge of zinc-based sacrificial layers.

Four types of the sacrificial coating were employed in this study: pure zinc coating on steel (fabricated by electrodeposition), Hot Dip Galvanized steel (HDG), ZA (9 wt. % Al), and ZAM (7 wt. % Al and 4 wt. % Mg). A galvanic corrosion prediction was established through the potentiodynamic polarization curves performed on the top surface of sacrificial coatings and steel in 0.1 M NaCl + 5.10^{-3} M cerium salts. Then, a local electrochemical technique (Scanning Vibrating Electrode Technique) was conducted on the cross-section of Zn-based coated steel in 0.015 M NaCl + 5.10^{-3} M inhibitor. In addition, cross-section characterizations of all substrates after 24 h of immersion in the electrolyte solution without and with inhibitor were analyzed by Scanning Electron Microscopy coupled with Energy Dispersive X-Ray Spectroscopy.

References:

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