Inhibitive effect of Ce(III) and molybdate on the corrosion resistance of Zn sacrificial coatings: effect of alloying compounds of the sacrificial layer

T. T. Nguyen, University of Mons, Mons/Belgium and Institute of Tropical technology, Hanoï/Vietnam; C. Arrighi, University of Mons, Mons/Belgium and La Rochelle University, La Rochelle/France; S. Akbarzadeh, University of Mons, Mons/Belgium, T.T. Thai/Institute of Tropical Technology, Hanoï/Vietnam; A.T. Trinh/Institute of Tropical Technology, Hanoï/Vietnam; C. Savall, La Rochelle University, La Rochelle/France, J. Creus, La Rochelle University, La Rochelle/France; M.-G. Olivier, University of Mons, Mons/Belgium

Sacrificial coatings, and particularly Zn-based ones, are commonly used to protect steel from corrosion. Different levels of protection can be reached depending on the alloying compounds added in the sacrificial layer such as Al, Mg and Fe.

This study aims at improving the corrosion resistance of the sacrificial layers by adding inhibitive species in aggressive chloride solution without losing the sacrificial properties in case of galvanic coupling. The alloying elements in the sacrificial layer have a significant impact on these protective properties and are specifically investigated.

Different sacrificial layers were used in this study: pure zinc and ZnFe (14 wt.% Fe) produced on steel by electrodeposition, Hot Dip Galvanized steel (HDG), ZA (9 wt. % Al) and ZAM (7 wt. % Al and 4 wt. % Mg). The corrosion resistance of bare substates without and with two inhibitive species (cerium chloride and sodium molybdate) was assessed. Two types of experiments were carried out. Electrochemical measurements (Electrochemical Impedance Spectroscopy and potentiodynamic polarization curves) were performed on the top surface of sacrificial layers and steel in 0.1 M NaCl + 0.005 M inhibitor. Then, a local electrochemical technique (Scanning Vibrating Electrode Technique) was used on the cut-edge of Zn coated steel samples in 0.015 M NaCl + 0.005 M inhibitor. Precipitation products formed on the top-surface and cut-edge after 24 h of immersion were analyzed by Scanning Electron Microscopy coupled with Energy Dispersive X-Ray Spectroscopy.