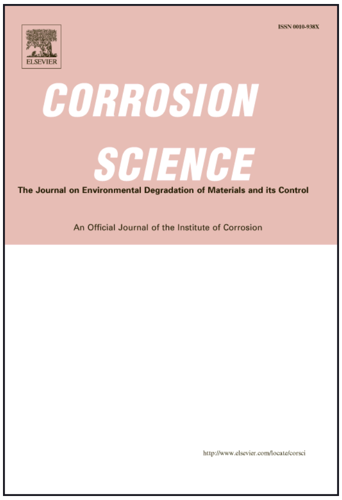

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Initial SO_2-induced atmospheric corrosion of ZnAlMg coated steel studied with *in situ* Infrared Reflection Absorption Spectroscopy

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Abstract:

The initial atmospheric corrosion of ZnAl2Mg2 coated steel in humid air with 80 ppb SO_2 was studied using *in situ* Infrared Reflection Absorption Spectroscopy, XRD and SEM. Corrosion products formed in SO_2- and SO_2 and NaCl containing environments on ZnAl2Mg2 (ZM) were dominated by Mg-containing sulphite and sulphates with sulphite formed mainly initially. The sulphite formation is connected with dissolution of the Mg-containing oxide layer present initially. This is followed by a localised corrosion process where Mg rich phase in the binary eutectic microstructure is dissolved anodically while the Zn-rich phase is the site for the cathodic oxygen reduction.

Keywords: Metal coatings, Atmospheric corrosion, IR-spectroscopy, XRD

1. Introduction

Zinc coatings containing Mg and Al for corrosion protection of steel were first developed in the late 1990s. These were mainly produced as relatively thick coatings which showed improved corrosion performance for heavy corrosive building applications [1]. During the last decades new zinc coatings with Mg or Mg and Al have been developed as alternatives for the conventional continuous hot dipped zinc coatings (HDG) and electrogalvanised (EG) zinc coatings. These new coatings have considerably higher corrosion resistance compared to HDG and EG in some exposure conditions. For instance, a 4- to 20-fold improvement in corrosion resistance in terms of time to red rust have been observed in the neutral salt spray test (NSST) [2,3,4] and an improvement by a factor of 2 to 3 for ZnMg and Zn-Al-Mg coatings exposed in cyclic automotive corrosion tests [5,6]. From several studies performed in chloride containing environments it is evident that the improvement of ZnAlMg coated steel compared to HDG is strongly dependent on the chloride load during exposure with the largest improvement observed in static conditions at high RH [7]. In a recent study, the initial atmospheric corrosion of ZnAlMg coated steel, EG and HDG was compared and it was shown that the initial corrosion products on ZnAlMg consisted of carbonate containing Mg/Al and Zn/Al layered double hydroxides (LDH) while corrosion products on EG and HDG consisted of zinc hydroxy chloride, zinc hydroxy carbonate and zinc oxide [8]. The improved corrosion resistance of ZnAlMg compared to EG and HDG was attributed to a pH regulating effect of Mg, which inhibited the formation of ZnO on these materials.

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