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Effect of Mg content on the corrosion properties of the Zn-Mg coatings synthesized using induction evaporation deposition

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Recently, due to the excellent corrosion resistance Zn-Mg coatings have been studied extensively for the protective coatings of steel sheets, compared with pure Zn coatings. Out of many processes for the deposition of the Zn-Mg coatings on the steel strip, evaporation deposition with induction heating was considered to be a strong candidate due to its high power efficiency and depostion rate. In this study, the Zn-Mg coatings with various Mg contents were synthesized on the steel substrates using evaporation deposition with induction heating and the effect of Mg content on the corrositon resistance of Zn-Mg coated steels was investigated using salt spray test (SST). The microstucture, the chemical composition, and the crystalline phase of the Zn-Mg coatings were investigated using the field emission scanning electron microscopy (FE-SEM), energy dispersive X-ray spectroscopy (EDS), and X-ray diffraction (XRD). The microstructure of pure Zn coatings showed the columnar structure. As Mg content of Zn-Mg coatings increased, the microstructure of Zn-Mg coatings changed gradually from the columnar structure to the featureless structure. The crystalline phase of the Zn-Mg coatings consisted of (Zn) and Mg_2Zn_{11}. The Zn-Mg coatings with high Mg content showed higher corrosion resistance compared to those with low Mg content since dense and featureless structure block the corrosive pathway. Moreover, the simonkolleite phase ($Zn_5(OH)_8Cl_2H_2O$) was observed at the corrosion product on the Zn-Mg coatings after corrosion test and this simonkolleite layer could be attributed to the improved corrosion resistance of Zn-Mg coating by protection against the corrosion environment.

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