

Corrosion Resistance of Zn-Al-Mg Materials under Cyclic Corrosion Test of GMW14872

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Abstract : Hot dip galvanizing is one of the most common anti-corrosion processes for steel plates. Owing to the increasing demand for better corrosion protection in the automotive and construction industries, numerous of new alloy coatings such as Zn-Al-Mg alloy coatings have been developed. In order to extend the anti-corrosion life of the automobile and achieve the anti-corrosion requirements of the car body for 12 years without perforation, the anti-corrosion means of pre-treatment and electrophoresis are generally adopted for the automobile plate. The corrosion resistance of Zn-Al-Mg alloy coating and hot-dip galvanized zinc (GI) coating after electrophoresis was studied by GMW14872 cyclic salt spray test. There are some polishing pits on the surface of GI coating plate and the Zn-Al-Mg alloy coating plate. Zn-Al-Mg alloy coating plate exists more oxides of Al and Mg on the surface. After 28 cycle corrosion test, the results show that the unilateral corrosion expansion width of GI coating is 5mm, and the width of Zn-Al-Mg alloy coating is only 2mm. This is due to the Zn-Al-Mg alloy coating contains a binary eutectic phase $MgZn_2$ with more negative potential, which makes it preferentially corroded during the corrosion process. Due to the large amount of OH^- produced by cathodic oxygen reduction, the pH value on the surface of the coating will increase, and the preferential dissolved Mg ions can inhibit the alkalization of thin liquid film on the surface of the coating, The lower pH value can promote the formation of protective coating $Zn_5(OH)_8Cl_2 \cdot H_2O$, which reduces the cathodic oxygen reduction rate. Thus, Zn-Al-Mg coating shows better underfilm corrosion resistance and has a wide application prospect in automobile parts.

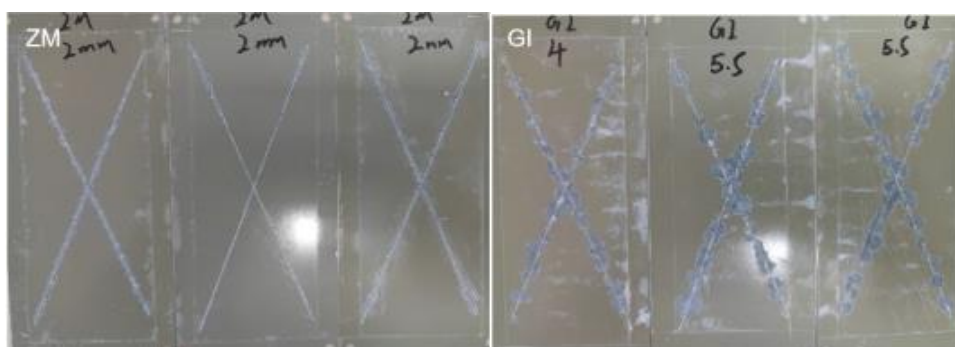


Figure 1 Photographs of ZM and GI coated steel plates after 28 cycles of GMW14872 cyclic salt spray test

Keywords : Zn-Al-Mg alloy coatings ; cyclic corrosion; Corrosion products

Reference

[1]PROSEK T, PERSSON D, STOULIL J, et al. Composition of Corrosion Products Formed on Zn - Mg, Zn - Al and Zn - Al - Mg Coatings in Model Atmospheric Conditions[J]. Corrosion Science, 2014, 86: 231-238.

[2] KOLTSOV, A., CORNU, M.J., LOISON, D. Characterization by Different Analytical Techniques of SiO₂ and Silane Thin Films Deposited on Rough Hot-dip Galvanized Steel Surfaces. Surface and Coatings Technology, 2012, 206 (11-12): 2759-2768.

[3]SCHUERZ S, FLEISCHANDERL M, LUCKENEDER G H, et al. Corrosion Behavior of Zn - Al - Mg Coated Steel Sheet in Sodium Chloride-Containing Environment[J]. Corrosion Science, 2009, 51: 2355 - 2363.