Effect of Silane Coating on the Corrosion Resistance of TiO₂ Conversion Films

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TiO₂ conversion films were prepared on surfaces undergoing the hot-dip galvanizing (HDG) process using titanium sulphate (Ti(SO₄)₂) as the titanium source and hydrogen peroxide (H₂O₂) as the chelating agent by a one-step impregnation method. The effect of passivation time on the morphology and corrosion resistance of the film was investigated. The results show that a large amount of TiO₂ nanospheres appear on the HDG surface after a short immersion time. By increasing the immersion time, the nanospheres are gradually covered by the ZnO/Zn(OH)₂ conversion film, and some cracks appear on the conversion film. The electrochemical results reveal that the integral TiO₂ conversion film shows better corrosion resistance, and the cracks cause the pitting of the corrosion resistance. To improve its corrosion resistance, the TiO₂ conversion film was modified by silane to realize hydrophobic sealing, which results in obvious changes in the morphology and corrosion resistance. After modification, the gel layer covered the TiO₂ conversion film, which would fill the cracks and make the film hydrophobic. Thus, the corrosion resistance of the modified conversion film increased. The better the hydrophobicity of the film is, the better the corrosion resistance of the film is for a short immersion time. In addition, the corrosion resistance of the hydrophobic film is mainly determined by the bottom TiO₂ conversion film.

Keywords: TiO₂; Hydrophobic; Conversion film; Corrosion resistance; Silane

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