Electrochemical Corrosion Behavior of Chromium-Free Composite Passivation Film on Galvanized Steel

Liu Zhaohua¹, Liu Cheng², Xu Zhengfeng¹, Ju Rong², Xiaohua Yu^{2*}, Zhang Yannan²

¹ Pan Gang Group Research Institute Co., Ltd., State Key Laboratory of Vanadium and Titanium Resources Comprehensive Utilization, Panzhihua 617000, China

² National Engineering Research Center of Solid Waste Resources, Kunming University of Science and Technology, Kunming 650093, China.

Liu Zhaohua and Liu Cheng have contributed equally to this paper.

*E-mail: xiaohua_y@163.com

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An eco-friendly and economical chromium-free composite passivation solution was prepared from ammonium molybdate, nanosilica sol, tannic acid, and silane coupling agents KH151 and KH792. This solution was coated onto galvanized steel and the micro-morphology, chemical composition, as well as corrosion resistance of the resulting film were analyzed via various methods. As a novel chromium-free composite passivation film, this coating combined the benefits of molybdate passivation and organosilane passivation. That is, the corrosion electrochemical reaction was inhibited, film exhibited high resistance, reaction speed decreased, and corrosion resistance increased. In addition, Mo inhibited the generation and development of micro-cracks, resulting in improved surface quality. The corrosion resistance of this passivation film was significantly higher than that of the silane passivation film. Furthermore, the optimal corrosion resistance of the galvanized steel was realized at a coating amount of 1252 mg/m². This work can serve as a reference for developing passivation technology for galvanized steel.

Keywords: galvanized steel sheet, chromium-free composite passivation film, electrochemical, corrosion resistance

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