

Microstructure and properties of oxalic acid-citric acid anodized film on 6063 aluminum alloy

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Abstract This study focuses on the widely used 6063 aluminum alloy in the industrial field, using oxalic acid and citric acid solutions as electrolytes to investigate the influence of oxalic acid concentration on the structure, wear resistance, and scale inhibition performance of the anodic oxide film. The phase composition of the oxide film was characterized by X-ray diffraction, and the microstructure of the oxide film was observed using scanning electron microscopy. Additionally, the corrosion resistance and scale inhibition performance of the anodic oxide film were tested. The research results show that the anodic oxide film is mainly composed of Al_2O_3 and exhibits a nanoporous structure when prepared with three different electrolyte concentrations. In particular, the oxide film prepared with 7.5% oxalic acid and 4% citric acid as electrolytes showed the best corrosion resistance, with a corrosion rate of 0.0030 $\text{g}/(\text{m}^2\cdot\text{d})$ after 480 hours of salt spray test, which is only 1/11 of the 6063 aluminum alloy substrate 0.0321 $\text{g}/(\text{m}^2\cdot\text{d})$. After 576 hours of immersion test, the corrosion rate of the oxide film was 0.458 $\text{mg}/(\text{dm}^2\cdot\text{d})$, while the corrosion rate of the aluminum substrate was 2.900 $\text{mg}/(\text{dm}^2\cdot\text{d})$, approximately 6 times that of the oxide film.

Keywords aluminum alloy; anodic oxidation; immersion test; corrosion resistance

Reference

- [1] **Hongxia Zhang**, Jingjie Dai, Caixia Sun, ShouyingLi. Microstructure and wear resistance of TiAlNiSiV high-entropy laser cladding coating on Ti-6Al-4V. Journal of Materials Processing Technology, 282 (2020) 116671:1-8
- [2] **Hongxia Zhang**, Jingjie Dai, Zhongwei Ma, Xiaoyan Wang, Nianlong Zhang, Effect of Y_2O_3 On Microstructures and Wear Resistance of TiC Reinforced Ti-Al-Si Coating by Laser Cladding on TC4 Alloy, Surface Review and Letters, 26 (2019) 1950077: 1-7
- [3] **H. X. Zhang**, J. J. Dai, C. X. Sun, S. Y. Li, H. L. Zhang, H. J. Yu & C. Z. Chen. Wear Rate and Thermal Conductivity of a Copper-Plated Graphite Flake/Aluminum Composite. Journal of Electronic Materials. (2019) 48:7585-7592