Effect of TiO₂ Nanoparticles on the Characteristics of MAO Coatings

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Micro-arc oxidation (MAO) coatings were prepared on 2024 aluminum alloy in silicate electrolytes with the addition of TiO₂ nanoparticles with varied contents from 0 g/L to 4 g/L. The voltage-time curves, micro-hardness, thickness, surface and cross-sectional morphologies, phase composition, adhesion, corrosion resistance and the process mechanism were analyzed. The results indicated that the oxidation voltage and thickness of the coatings increased gradually with the addition of the TiO₂ nanoparticles. The coating phase composition contained TiO₂. The size of the micro-pores increased, but the size of the sintered disc decreased on the surface of the MAO coatings, so the surface became more compact. Therefore, the micro-hardness and corrosion resistance of the coatings increased as the TiO₂ nanoparticle concentration increased. Moreover, the adhesion of the coatings also increased because of the increase in the coating thickness. Above all, the performances of the MAO coatings with TiO₂ nanoparticles were improved.

Keywords: Micro-arc oxidation; 2024 Aluminum alloy; MAO coatings; TiO₂ nanoparticles

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