Effect of Nd₂O₃ Particles Addition on the Crack Resistance of Micro-arc Oxidation Coatings on Cast Aluminum Alloy

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Micro-arc oxidation coatings were fabricated on cast aluminum alloy in electrolytes with the Nd₂O₃ particles addition varying from 0 to 0.4 g/L. The microstructure, phase composition, corrosion resistance and thermal shock resistance of the coatings were characterized by Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), Electrochemical Workstation and Chamber Electric Furnace, respectively. It was found that the size of the micropores on the surface of the coatings increased with the addition of the Nd₂O₃ particles, while the number of micropores gradually decreased. After the thermal shock tests, the holes on the coating surface decreased, and the coatings became more compact with the addition of the Nd₂O₃ particles; furthermore, the cracks also decreased and even disappeared with an increase in the Nd₂O₃ particle concentration, which proved that adding Nd₂O₃ particles in the electrolytes could substantially strengthen the thermal shock resistance of the coatings. The results of the XRD analyses indicated that the coatings mainly consisted of γ -Al₂O₃, SiO₂ and Si phases. In addition, the corrosion rate of the coatings decreased slightly with the addition of the Nd₂O₃ particles; thus the corrosion resistance of the coatings was gradually improved.

Keywords: Micro-arc oxidation; Cast aluminum alloy; Nd₂O₃ particles; Crack resistance

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