Effect of the Precipitated Phases on Corrosion Behavior of Mg-Y-Nd Ternary Alloy

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Mg-5Y-xNd alloys (x=0.5, 1.0, 1.5 wt.%.) were investigated to reveal the influence of precipitated phase on corrosion resistance. The microstructure, precipitated phases and corrosion behaviors of different samples were analyzed by scanning electron microscope, energy dispersive spectrometer and X-Ray Diffraction. The volume fraction of the Mg₁₂(Y,Nd) phase increased, whereas that of the Mg₃(Y,Nd) phase decreased with increasing Nd-content. The weight loss rate decreased from 10.9584 mg·cm⁻²·d⁻¹ (23.0126 mm·y⁻¹) to 6.2184 mg·cm⁻²·d⁻¹ (13.0586 mm·y⁻¹). The open circuit potential, potentiodynamic polarization curve, electrochemical impedance spectroscopy and scanning kelvin probe confirmed that the corrosion rates of Mg-5Y-xNd alloys follow the order Mg-5Y-0.5Nd > Mg-5Y-1.0Nd > Mg-5Y-1.5Nd. This phenomenon occurred because the Mg₃(Y,Nd) precipitated phase with a face-centered cubic lattice had a more positive potential than the Mg₁₂(Y,Nd) phase with an orthorhombic lattice. Thus, the Mg₃(Y,Nd) precipitated phase acted as the cathode of the electrochemical reaction, and accelerated the corrosion of the Mg matrix more effectively than the Mg₁₂(Y,Nd) phase.

Keywords: Mg-Y-Nd alloy; Microstructure; Precipitated phase; corrosion resistance; Electrochemistry

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