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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 Mg_{12}(Y,Nd) phase increased, whereas that of the Mg_3(Y,Nd) phase decreased with increasing Nd-content. The weight loss rate decreased from 10.9584 $mg \cdot cm^{-2} \cdot d^{-1}$ (23.0126 $mm \cdot y^{-1}$) to 6.2184 $mg \cdot cm^{-2} \cdot d^{-1}$ (13.0586 $mm \cdot y^{-1}$). The open circuit potential, potentiodynamic polarization curve, electrochemical impedance spectroscope 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 Mg_3(Y,Nd) precipitated phase with a face-centered cubic lattice had a more positive potential than the Mg_{12}(Y,Nd) phase with an orthorhombic lattice. Thus, the Mg_3(Y,Nd) precipitated phase acted as the cathode of the electrochemical reaction, and accelerated the corrosion of the Mg matrix more effectively than the Mg_{12}(Y,Nd) phase.

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

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