Corrosion Behaviour and Electrochemistry of Mg-5Y-2Nd-0.5Zr-xSm (x=0, 1, 3 and 5) Alloys in 3.5 wt.% NaCl

Yunwei Gui¹, Quanan Li^{1, 2,*}, Jun Chen¹, Qing Zhang¹, Sanling Fu¹, Limin Zhu¹

¹ School of Materials Science and Engineering, Henan University of Science and Technology, Luoyang 471023, China

² Collaborative Innovation Center of Nonferrous Metals, Henan Province, Luoyang 471023, China

*E-mail: guiyunwei1@163.com

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The effects of Sm on the corrosion behaviours and electrochemistry of Mg-5Y-2Nd-0.5Zr magnesium alloy were studied by the static weight loss method, electrochemical analysis, scanning electron microscopy and XRD. The results showed that the addition of Sm increased the open circuit potentials of the tested alloys, decreased their self-corrosion current densities, and improved their corrosion resistances. As the Sm content increased, the corrosion rate of the alloy first decreased and then reached a minimum at 3 wt.% Sm. At 3 wt.% Sm content, the corrosion rate of the alloy decreased to 0.2121 mg.cm⁻².h⁻¹, which was 57% of that of the original alloy. At the same time, the Sm formed a new Mg₄₁Sm₅ phase in the alloy, which changed the quantities and distributions of the second phases in the Mg-5Y-2Nd-3Sm-0.5Zr alloy. Adding a proper amount of Sm refines the precipitates and makes the components and tissues uniform. The uniform, fine second phases could provide a good barrier against the generation and expansion of corrosion, thereby significantly improving the corrosion resistance of the alloy.

Keywords: Mg-Y-Nd-Sm alloy, Sm, Second phases, Corrosion resistance, Electrochemistry

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