Multiple transitional metal oxides phosphate conversion coating on Mg-Gd-Y-Zr alloy toward high corrosion resistance and low electrical contact resistance

Siyu Sun[1], Peng Zhou[2], Tao Zhang[1], Fuhui Wang[1]

[1]*Corrosion and protective center, Northeastern University, 3-11 Wenhua Road, Shenyang, 110819, China*

[2]*The State Key Laboratory of Rolling and Automation, Northeastern University, Shenyang 110819, P.R. China*

Abstract: A phosphate-manganese-vanadium conversion coating (PMVCC) was successfully developed on Mg-Gd-Y-Zr alloy with high corrosion resistance and low electrical contact resistance. In this work, the design of low electrical contact resistance coating use transition metal oxides with low energy bands, doping transition metal ions into the phosphate lattice lowers its band gap during the formation of coating. While corrosion-resistant conversion of coatings relies on phosphate. Result show that the PMVCC was mainly composed of $CaHPO_4$, Mn_2O_3, MnO_2, V_2O, V_2O_5 by XPS, Raman and TEM. Meanwhile, the Mn^{2+} produced by the reaction of permanganate doped in the crystal lattice of $CaHPO_4$ lead to the conductive was improved, as calculated by the first-principle of Density Functional Theory. The thickness of PMVCC increased from1 μm to 2 μm with the increase of immersion time from 15 min to 25 min. As a result, the contact resistance increased from 150 to 276 mΩ, meanwhile, the neutral salt spray test showed that the onset of surface corrosion was delayed from 120 to 240 hours. It evidently promotes the conductive and corrosion resistance of PMVCC.

Keyword: transitional metal oxides, phosphate conversion coating, corrosion resistance, Mg alloy, First-principles calculation