Effect of Fluoride on Adhesion of Electroless Nickel-Phosphorus Coating on MAO-coated AZ31B magnesium alloy

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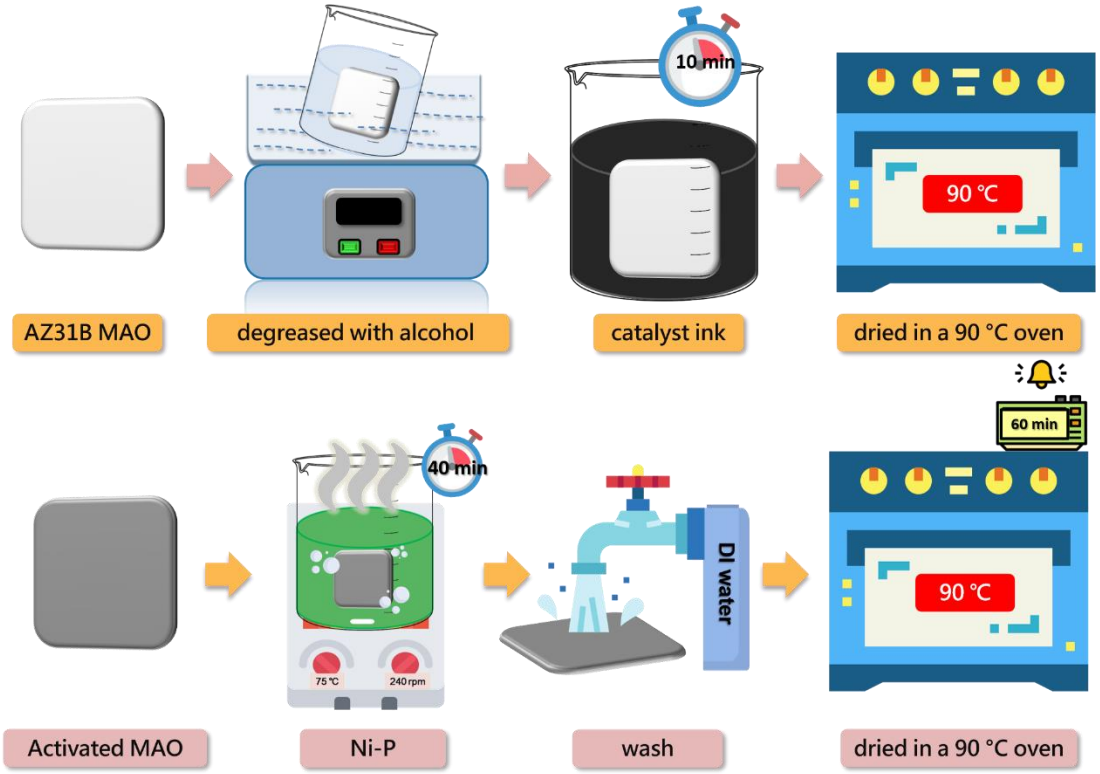
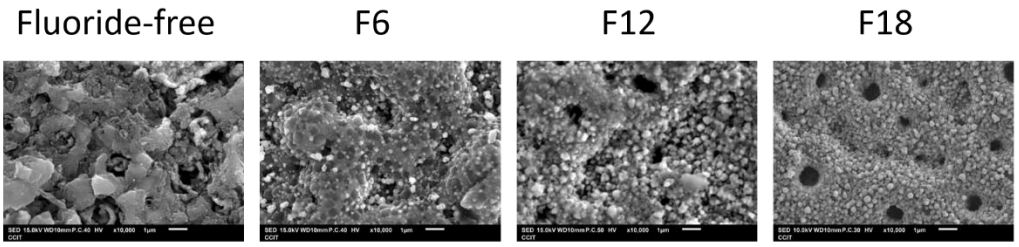
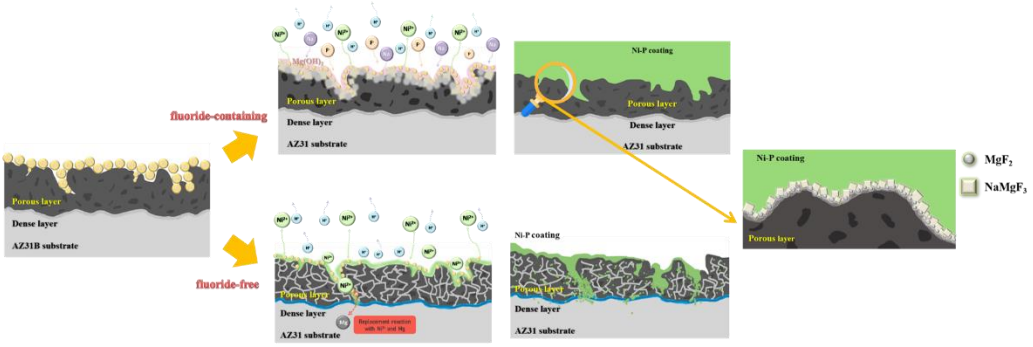
Abstract

The MAO of magnesium alloy is nickel-phosphorus (Ni-P) plated. The Ni-P coating can make the MAO coating conductive, which is convenient for subsequent processing and improves its applicability.Most of references about electroless nickel-phosphorus plating of magnesium alloys mentions that fluoride is added to the electroless plating solution. It is also known from previous study that fluoride has a certain protective effect on magnesium alloys and keep the electroless plating solution in a stable state.In this study, the MAO of magnesium-aluminum alloy was improved its corrosion resistance. The MAO coating of magnesium-aluminum alloy with high corrosion resistance and uniform pore size was coated with Ni-P plating, Focus on different level fluoride (NH_4HF_2) in the electroplating solution. fluoride-free, 6 g/L ,12 g/L and 18 g/L , observing the bonding force and corrosion resistance of MAO coating with Ni-P coating.Scanning Electron Microscope (SEM) and Elemental Composition Analysis (EDS) Mapping to observe surface morphology and elements,The adhesion of Ni-P coating test by the Posi-test AT-M pull-off adhesion tester, PDP tests by Versa STAT 4 potentiostat/frequency to analyze the corrosion behavior of the MAO/Ni–P composite coatings, and the salt spray test (SST) is used to judge the characteristics of the Ni-P coating with different level fluoride.The results show that the nickel plating solution without fluoride ions will corrode the high corrosion resistance MAO coating, and the Ni-P coating will be coated and peeled off. , it will also damage the MAO coating. In fluoride-free situation , the broken MAO coating has poor bonding force with Ni-P coating and very easy to peel off, a complete Ni-P coating can be obtained by adding the appropriate amount of fluoride, and the adhesion of Ni-P coating 6 g/L ,12 g/L and 18 g/L respectively 5.62Mpa, 7.61 Mpa and 2.33 Mpa. Ni-P coating 12 g/L has better adhesion and corrosion resistance on the MAO coating of AZ31B magnesium alloy.

Keywords: AZ31B magnesium Alloy、Fluoride、$NaMgF_3$、Electroless Ni–P plating、Adhesion、Corrosion resistance


10 min
90 °C
AZ31B MAO
degreased with alcohol
catalyst ink
dried in a 90 °C oven
60 min
40 min
DI water
90 °C
75 °C
240 rpm
Activated MAO
Ni-P
wash
dried in a 90 °C oven


Fluoride-free
F6
F12
F18


fluoride-containing
fluoride-free
Porous layer
Dense layer
AZ31B substrate
AZ31 substrate
Ni-P coating
MgF2
NaMgF3