A facile Fluoride Sealing Treatment to Improve Corrosion Resistance of Magnesium Alloy (AZ31B) Micro-arc Oxidation Layer

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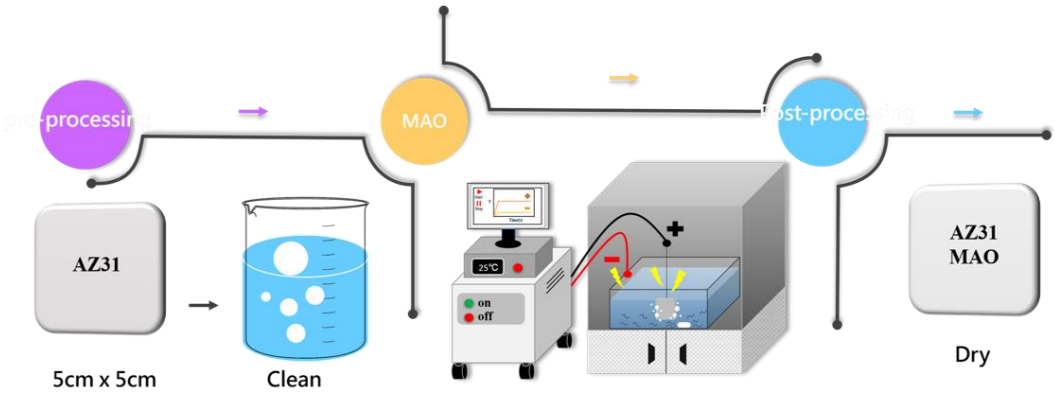
Abstract

In this study, MAO treatment was used to generate a high corrosion resistance MAO layer on AZ31B magnesium aluminum alloy, During the MAO treatment, the coating will be solidified and contracted owing to thermal stress gradient, resulting in structural defects such as microcracks on the surface . Unfortunately, corrosive ions (such as Cl^- and H^+) will penetrate into the substrate through these structural defects, which deteriorates the protective performance. The porosity, pore size distribution and connectivity with the substrate play an important role in the performance of corrosion resistance. In order to maintain the integrity of the MAO layer, the surface of the MAO layer is sealed with a fluorine (NaF) compound containing, so that the MAO surface covers $NaMgF_3$. The protective $NaMgF_3$ cubic lattice fills the defects to optimize the corrosion resistance of magnesium aluminum alloys.

Scanning electron microscopy (SEM) microscope equipped with Energy Dispersive Spectrometer (EDS) was used to observe the surface of the MAO and fluoride post- sealing treatment coatings, and to detect the corrosion performance of the coating by the polarization curve, with salt spray test (SST) for a long time observe the occurrence of pitting corrosion in sealing treatment over time. According to the surface morphology, the number of $NaMgF_3$ by low-concentration short-term fluoridation post-treatment is small and only locally distributed, and the surface structure of the micro-arc itself does not change significantly. After high-concentration fluoridation for five mins The $NaMgF_3$ particles are evenly distributed, and more particles go deep into the hole to achieve proper protection.

The relationship between the concentration of the fluorinated post-treatment solution and the soaking time has an extreme value on the corrosion efficiency of the micro-arc layer. The corrosion resistance is the best at a certain concentration. After soaking in 0.5 M fluorinated sealing solution for five mins. According to the polarization curve, icorr 1.08 $\chi 10^{-9}$, in SST, compared with the MAO layer without sealing treatment, the storage time can extend double, and after sealing, it can be stored for more than 480 hours without surface discoloration and pitting. Based on the above experimental results, can understand about fluoride sealing post-treatment, the appearance of pitting can be delayed, and it is confirmed that the fluoride sealing post-treatment by simple immersion can strengthen the local defects of MAO coating on AZ31B magnesium alloy, raise up corrosion resistance optimization.

Keywords: micro-arc oxidation, magnesium-aluminum alloy, AZ31B, fluoride, post-sealing treatment, $NaMgF_3$, corrosion resistance.



fluoride post- sealing treatment