# Surface morphology and electrochemical property of Mg-Al alloys anodized in alkaline solutions and sealed

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## INTRODUCTION

Magnesium has the lowest density among metals and very superior specific strength. Recently, it is taken a great interest to apply automobile parts, mobile personal computer and cellular phone etc. Surface treatments on Mg are necessary to protect the corrosion because Mg is considerably active metal in electrochemically. On the other hand, chromate conversion coating methods are still one of the most efficient surface treatments but have a lot of problems to environment and recycling. Therefore, this paper shows the electrochemical behavior of anodizing film of Mg-Al alloys (AZ91) in alkaline solutions. Moreover, electrochemical property and surface morphology were investigated with parameter of sealing time, temperature in pure water, NaOH, $Al(OH)_3$ solutions.

## EXPERIMENTAL

The Mg-Al alloy electrodes were mounted with epoxy resin except for exposed area of 100 $mm^2$, and had been polished with 0.05 μm alumina powder. The specimens were degreased with acetone and water. The electrochemical system consisted of Pt coil as a counter electrode, and Ag/AgCl sat. KCl as a reference electrode. The anodizing was performed at 298 K in alkaline solution such as 1 $moldm^{-3}$ NaOH containing various concentration of $Al(OH)_3$. The solution was stirred during all experiments. Anodizing of Mg-Al alloys were carried out at constant potentials.

Sealing was carried out as a function of time, temperature in pure water, NaOH, $Al(OH)_3$ solution. The anodic polarization curves of specimens anodized at constant potentials were measured in 0.017 $moldm^{-3}$ NaCl containing 0.1 $moldm^{-3}$ $Na_2SO_4$ solution at 298 K with a scan rate of 1 $mVs^{-1}$, in order to characterize the corrosion resistance of the anodizing films. The anodizing films were also evaluated using SEM, XRD, and EDX.

## RESULTS AND DISCUSSION

Anodic current increment corresponding to the active dissolution reaction was observed for the potential region between 3 and 7 V for all specimens in anodic polarization experiment. Sparking was observed at above 80 V. With increasing $Al(OH)_3$ content in NaOH solution, the current density in the passive state decreased. While the relative intensity of $Mg(OH)_2$ in XRD analysis decreased with increasing applied potential, that of MgO increased. The anti-corrosion property of $Mg(OH)_2$ was better than that of MgO. The most of $Mg(OH)_2$ were generated at high current density at low potentials. Therefore, we investigated at potential which current density was high, preponderantly. The best anti-corrosion property by anodic polarization were appeared 4 or 5 V among specimens anodized for 10 min in various alkaline solutions. Surface morphology of anodized specimen at 4 or 5 V was rough, with a lot of cracks. The number of cracks was decreased with increasing sealing temperature, time by pure water. Especially, specimen sealed at 371 K had few cracks. The best anti-corrosion property appeared in the case of sealed in NaOH solution among various sealing solution.