Anodizing science of valve metals

Sungmo Moon[a,b]
[a] Korea Institute of Materials Science, Surface Technology Division (E-mail: sungmo@kims.re.kr)
[b] Korea University of Science and Technology, Advanced Materials Engineering

초 록: This presentation introduces anodizing science of typical valve metals of Al, Mg and Ti, based on the ionic transport through the andic oxide films in various electrolyte compositions. Depending on the electrolyte composition, metal ions and anions can migrate through the andic oxide film without its dielectric breakdown when point defects are present within the anodic oxide films under high applied electric field. On the other hand, if anodic oxide films are broken by local joule heating due to ionic migration, metal ions and anions can migrate through the broken sites and meet together to form new anodic films, known as plasma electrolytic oxidation (PEO) treatment. In this presentation, basics of conventional anodizing and PEO methods are introduced in detail, based on the ionic migration and movement mechanism through anodic oxide films by point defects and by local dielectric breakdown of anodic oxide films.

Changes in the electrochemical properties of air-formed oxide film-covered AZ31 Mg alloy in aqueous solutions containing various anions

Basit Raza Fazal[a,b,*], Sungmo Moon[a,b]
[a] Korea Institute of Materials Science, Surface Technology Division (E-mail: basitraza@kims.re.kr),
[b] Korea University of Science and Technology, Advanced Materials Engineering

초 록: This research was conducted to investigate the electrochemical properties of the thin air-formed oxide film-covered AZ31 Mg alloy. In this work, native air-formed oxide films on AZ31 Mg alloy samples were prepared by knife-abrading method and the changes in the electrochemical properties of the air-formed oxide film were investigated in seven different electrolytes containing the following anions Cl^-, F^-, SO_4^{2-}, NO_3^-, CH_3COO^-, CO_3^{2-} and PO_4^{3-}. It was observed from open circuit potential (OCP) transients that the potential initially decreased before gradually increasing again in the solutions containing only CO_3^{2-} or PO_4^{3-} ions, indicating the dissolution or transformation of the native air-formed oxide film into new more protective surface films. The Nyquist plots obtained from electrochemical impedance spectroscopy (EIS) showed that there was growth of new surface films with immersion time on the air-formed oxide film-covered specimens in all the electrolytes; the least resistive surface films were formed in fluoride and sulphate baths whereas the most protective film was formed in phosphate bath. The potentiodynamic polarization curves illustrated that passive behaviour of AZ31 Mg alloy under anodic polarization appears only in CO_3^{2-} or PO_4^{3-} ions containing solutions and at more than $-0.4\ V_{Ag/AgCl}$ in F^- ion containing solution.