

## Effect of Anion Additives on Etch Tunnel Growth of Pure Aluminium Foil for Aluminium Electrolytic Capacitor

음이온의 첨가가 알루미늄 전해 커패시터용  
순수 알루미늄 foil의 etch tunnel의 성장에 미치는 영향

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The effects of sulphate( $\text{SO}_4^{2-}$ ), bisulphate( $\text{HSO}_4^-$ ) and thiosulphate( $\text{S}_2\text{O}_3^{2-}$ ) ion additives on etch tunnel growth of pure aluminium (Al) foil for Al electrolytic capacitor have been investigated in chloride-containing solution as functions of anion concentration and solution temperature using scanning electron microscopy(SEM) and electrochemical impedance spectroscopy. The Al specimen, which was previously etched in various solution conditions, was anodized in a 0.5 M  $\text{H}_3\text{BO}_3$  + 0.05 M  $\text{Na}_2\text{B}_4\text{O}_7$  solution at  $1 \text{ mAcm}^{-2}$  up to 30 V and held at 30 V for a further 30 min to form the oxide replica on Al foil. To observe the change in the etch tunnel morphology with the addition of anions, the etch tunnel morphology was characterized with the help of SEM after dissolving Al foil by immersing in a bromine-methanol solution. From SEM observation, it appeared that the tunnel density decreases and at the same time the etch tunnel morphology changes from simple cubic structure to complicated circular structure by adding  $\text{SO}_4^{2-}$ ,  $\text{HSO}_4^-$  and  $\text{S}_2\text{O}_3^{2-}$  ions to NaCl solution. The effect of anion addition on the surface area was also investigated by calculating the oxide film capacitance from electrochemical impedance spectra. Based upon the experimental results, the beneficial effects of  $\text{SO}_4^{2-}$ ,  $\text{HSO}_4^-$  and  $\text{S}_2\text{O}_3^{2-}$  ions on etch tunnel growth were discussed in terms of the changes in morphology and surface area. In addition, etch tunnel growth promotion mechanisms in the presence of  $\text{SO}_4^{2-}$ ,  $\text{HSO}_4^-$  or  $\text{S}_2\text{O}_3^{2-}$  ions were proposed.

### References

1. W.-J. Lee and S.-I. Pyun, *Electrochim. Acta*, 45 (2000) 2781.
2. K.-H. Na and S.-I. Pyun, Abstract 144, Proceedings of 15th International Corrosion Congress, Granada, Spain, September 22-17 (2002).