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Effect of Etch Tunnel Size Distributions of Aluminium Foil on Capacitance for Aluminium Electrolytic Capacitor

알루미늄 foil의 etch tunnel 크기분포가 알루미늄 전해 커패시터의 커패시턴스에 미치는 영향

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The present work involves the effect of etch tunnel size distributions of aluminium foil on capacitance for aluminium electrolytic capacitor using scanning electron microscopy, electrochemical impedance spectroscopy and galvanostatic charge/discharge experiment. The aluminium foil specimens were pretreated before etching by immersion in a 1 M NaOH solution at room temperature for 10 min to enhance uniformity of the distribution of tunnel lengths and widths. Etching was carried out under galvanostatic polarization as functions of etchant composition and temperature to control etch tunnel size. Then the specimens were anodized in a 0.5 M H_3BO_3 + 0.05 M $Na_2B_4O_7$ solution at 1 $mAcm^{-2}$ up to 30 V. The etch tunnel size distributions were characterized roughly by the help of scanning electron microscopy. The resistive and capacitive elements were estimated by using complex non-linear least square fitting of the ac-impedance spectra to the proposed equivalent circuit suitable for modeling porous tunnel etched structure. The current transients were simulated from the analysis of the equivalent circuit at a potential step during charging/discharging. Simulated current transients accorded well in shape and value with those experimentally measured. From the results, it was concluded that the capacitance is closely related to etch tunnel size distributions of an aluminium foil and the estimation of capacitance from the characterization of etch tunnel size distributions is possible.

References

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