The Impact of Corrosion Inhibitors on the Performance of Etched Foil Prepared for Aluminum Electrolytic Capacitors at High Production Speeds

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Abstract The effects of phosphoric acid, Polystyrene sulfonic acid(PSSA), and the corresponding composite corrosion inhibitors on the specific capacitance and bending performance of the anode aluminum foil is studied in this work. The efficiency and mechanisms of inhibition is revealed by characterizing the relationship among the inhibitor and the pit morphology, the characteristics of electrochemical polarization and impedance spectroscopy. Phosphoric acid, as a corrosion inhibitor, enhances the acidity of the corrosive solution, accelerating the corrosion of aluminum foil while simultaneously generating an oxide film on its surface to protect it. When the concentration of phosphoric acid is 0.09mol/L, the specific capacitance reaches its maximum of 0.818 μF/cm^2. The addition of PSSA to the etching solution for pore expansion creates a protective film on the aluminum foil surface due to its long molecular chains that intertwine irregularly, preventing them from entering the tunnel pores. This achieves a corrosion inhibiting effect. When the PSSA content is 0.4mL/L, the specific capacitance achieves its maximum of 0.772 μF/cm^2. By combining phosphoric acid and PSSA in a composite ratio, both corrosion inhibitors can simultaneously act on the surface of aluminum foil. When the corrosion inhibitor ratio is set at 0.06mol/L for phosphoric acid and 0.1mL/L for PSSA, the specific capacitance reaches 0.839 μF/cm^2. The choice of a composite corrosion inhibitor not only reduces the amount of corrosion inhibitor required but also achieves a superior corrosion inhibiting effect, resulting in a significant enhancement in specific capacitance.

Keywords aluminum electrolytic capacitor, ecthed foil, corrosion inhibitor

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