Effects of Complexing Agents and Current Density on Carbon Content of Trivalent Chromium Carbon Coating and Its Properties

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Chromium carbon coatings were electroplated from trivalent chromium chloride based electrolyte at different complex agents such as HCOONH_4 , HCOONa and Glycine. The effects of different complex agents on morphology, chemical composition, contact angle, ICR values and corrosion resistance of coatings were investigated. All the electroplated conditions indicated that the carbon content within chromium carbon coatings decreased with an increase of current density due to the chelation strength of complexing agents in the bath collapsed by a higher drive force (higher current density). Results also presented that the chromium carbon coatings electroplated from “ HCOONa ” will form granular structure with an increase of current density, and leading to a poor ICR values. Both coatings electrodeposited from “ HCOONH_4 ” and “Glycine” has better contact angle (about 105° and 112°) and ICR values ($<20 \text{ m}\Omega\text{cm}^2$ at 160 N cm^{-2}), but the “Glycine” has a poor corrosion resistance. In this study, chromium carbon coatings electroplated from “ HCOONH_4 ” have better contact angle (105°), ICR values ($<20 \text{ m}\Omega\text{cm}^2$ at 160 N cm^{-2}) and corrosion resistance ($3.90 \times 10^{-7} \text{ A/cm}^2$), and has high application potential in bipolar plates.

Keywords: chromium carbon coatings; complexing agents; contact angle; ICR values

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