

Study of the air-formed oxide layer at the copper surface and its impact on the copper corrosion in an aggressive chloride medium

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Résumé en anglais The electrochemical behaviour of pre-oxidized copper surfaces prepared by heating in air at 90°C was studied to evaluate the impact of the air-formed oxide layer at the copper surface on the corrosion in an aggressive chloride medium. In a first part, the evolution of the chemical composition and the structure of the air-formed oxide layer with the heating time were investigated by cyclic voltammetry in an alkaline medium in which the different oxide species can be discriminated, X-ray photoelectrons spectroscopy experiments (XPS) and water contact angle measurements. It was demonstrated that short heating times produce Cu₂O-rich films, while CuO-rich films were obtained after long heating-time periods. Furthermore, cyclic voltammetric data strongly support a stratification of the corrosion products in the mature oxide layer. In a second part, the protection efficiency of air-formed films, aged from 1 to 22 days, against the copper corrosion was study using a potentiodynamic technique and the electrochemical impedance spectroscopy (EIS) in an aerated 0.2 M NaCl aqueous electrolyte. Results demonstrate that the chemical composition of the air-formed oxide layer has an important impact in the overall corrosion process. Results are tentatively explained in terms of composition and structure of the oxide layer.

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