Effect of Current Density Distribution on The Film Coating Formation in Anodization of Aluminum Using Multiphysics Simulation

Abstract— Distribution of electric field in the electrolyser during aluminium anodizing is one of several crucial factors, affecting formation of coatings on the aluminum substrates. In this study, a relatively simple COMSOL model was considered to assist observation of the distributions of the current density under different types of electric field determined by different distance between the working electrode (anode) and the cathode. The approach of the study attempts by combining simulation results with some literature experiments influences in current distribution during anodization of aluminum.

In order to investigate effects of the distance between the working electrodes inside the cell on the growth rate anodized film, five different distances between the anode and cathode have been proposed in this study. The simulation results indicate that the current distributes non-uniformly along the substrate surfaces and decreases from the edges to the center. With increasing distance, the current density from edges to the center get smaller. The simulation results showed also, that the electrode distance strongly influences the current density due to the current field distribution in the electrolyser. In all cases, the current density values at the edges are approximately twice the values of on the middle.

Index Terms—anodizing, current distribution, simulation, distance, thickness.