Role of electrode temperature in anodic growth of sulfuric acid alumina films

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Abstract: Studies of the self-organized growth of nanoporous anodic aluminum oxide (AAO) films and anodization parameters have been the subject of decades of research and various theories. At the same time, temperature, being one of the most important parameters in anodizing treatments of aluminum, has been investigated only as a function of electrolyte temperature. This paper presents the results of studying the growth kinetics and morphology of AAO formed by anodization processes in 1 M H_2SO_4 at different anode temperatures. The activation energy of ionic conductivity for AAO determined in this study was 0.41 eV for sulfuric acid, which was greater than the activation energy of 0.34 eV for oxalic acid. The effect of anode temperature on the pore diameter (d_{pore}) and the interpore distance (D_{inter}) was studied. It was demonstrated that in the temperature range from 10 to 40 °C, the d_{pore} and D_{inter} did not change with the anode temperature, with values equal to 12.5 ± 0.1 nm and 52.5 ± 0.2 nm, respectively. However, when the anode (aluminum) temperature was increased to 60 °C, the d_{pore} increased to 16 nm. The results obtained show that by increasing

the temperature of the anode from 20 to 40 °C, it is possible to increase the ionic conductivity of AAO and thus achieve a greater than threefold increase in the the rate of AAO growth, without altering the porous morphology of the anodic films.

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