



Cairo University

NANO POROUS ALUMINUM OXIDE FILM FABRICATION AND CHARACTERIZATION

By

Mohamed Abdel-Hameed Ragab Mohamed Hassan

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Metallurgical Engineering

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Title of Thesis: Nano porous Aluminum Oxide Film Fabrication and Characterization
Key Words: Nanoporous Film, Anodization parameters, Characterization, Capacitance, Impedance spectroscopy.

Summary:

Porous anodic aluminum oxide is a result of anodizing of aluminum in mild acidic solution and has a wide spectrum of applications including electronic, magnetic, optical and biological application. In this thesis, the effect of variation of anodization voltage, temperature and electrolyte concentration on anodization of commercially pure aluminum was studied. The resulted porous anodic alumina film was characterized by SEM, EDX, XRD, image analysis, capacitance measurement, and impedance measurements for each condition. Theoretical calculations concerning weight change and anodization efficiency were conducted. SEM image analysis showed that increasing anodizing voltage, temperature, or electrolyte concentration affects in a significant way pore diameter, interpore distance and film porosity. EDX analysis showed that the porous alumina oxide layer formed contains oxygen, aluminum and sulfur elements. X-rays diffraction showed non-crystallinity of alumina film and peaks revealed are related to the aluminum substrate. Capacitance measurements showed a high ability of porous alumina layer to store electric charges and this ability decrease as any or all of anodization voltage, temperature, and electrolyte concentration increased. AC-Impedance spectroscopy confirmed all what obtained from capacitance measurements. As a conclusion, the variation in anodization voltage, temperature and electrolyte concentration are crucial to be controlled to achieve the required porous film morphology and properties.

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