Surface morphology analysis of copper films produced by anodizing process

Meruyert Kadir[1*], Balaussa Alpysbayeva[2], Vladimir Smirnov[3]
[1]al-Farabi Kazakh National University, Almaty, Kazakhstan
[2]Laboratory engineering profile of al-Farabi Kazakh National University, Almaty, Kazakhstan
[3]Forschungszentrum Jülich (FZJ), Germany
E-mail: meruyert.kadir@mail.ru

Currently, copper oxide films are of interest to researchers due to their environmental friendliness, rich resources and low cost. Copper oxide is a p-type semiconductor with a narrow band (1.9 eV-2.2 eV). This material is characterized by the possibility of effective application in sensors [1], hydrogen production [2], energy conversion [3], for the creation of supercapacitors [4], semiconductor catalysis [5], biosensorics [6].
The anodizing process allows you to obtain porous materials based on metal oxides. As with aluminum and titanium oxides, the anodizing process can produce a porous material based on copper oxide. Anodizing is a low-temperature, versatile, economical and simple method. In addition, anodizing allows to change the morphology and size of the copper oxide nanostructure to some extent [7].

In the course of practical work, a copper plate with a size of several microns was used as the initial material. The process of single-stage anodizing was performed at a temperature of 4°C for 90 seconds in an electrolyte of an acidic environment. As a result, the morphology of copper films was studied using Ntegra Therma (NT - MDT) atomic force microscopy. AFM shows that the surface morphology depends on various chemical bonds on the surface of copper.

References

[1] S. Deng, V. Tjoa, H.M. Fan, H.R. Tan, D.C. Sayle, M. Olivo, S. Mhaisarkal, J. Wei, C.H. Sow, J. Am. Chem. Soc., 134 (2012) 4905.
[2] P.E. De Jongh, D. Vanmaekelbergh, J.J.D. Kelly, J. Electrochem. Soc., 147 (2000) 486.
[3] A. Bhaumik, A. Haque, P. Karnati, M. Taufique, R. Patel and K. Ghosh, Copper oxide based nanostructures for improved solar cell efficiency, Thin Solid Films 572 (2014) 126–33.
[4] X. Dong, K. Wang, C. Zhao, X. Qian, S. Chen, Z. Li, H. Liu, S. Dou, J. Alloy. Compd., 586 (2014) 745.
[5] R. Poreddy, C. Engelbrekt and A. Riisager, Copper oide as efficient catalyst for oxidative dehydrogenation of alcohols with air Catal. Sci. Technol. 5 (2015) 2467–77.
[6] L. Xu, Q. Yang, X. Liu, J. Liu and X. Sun, One-dimensional copper oxide nanotube arrays: biosensors for glucose detection RSC Adv. 4 (2014) 1449–55.
[7] A. Mohammadpour, M. Eltahlawy, A. Martino, A.M. Askar, R. Kisslinger, R. Fedosejevs and K. Shankar, Optical limiting in Cu/CuO nanostructures formed by magnetic field-assisted anodization J. Nanosci. Nanotechnol. 17 (2017) 5019–23.