ELECTROCHEMICAL SYNTHESIS OF NANOSTRUCTURED ZINC OXIDE LAYERS

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Nanostructured materials are very interesting due to their promising properties, different from their bulk counterparts. But the synthesis of this kind of structures is not easy, since obtaining well-defined structures usually requires sophisticated equipment or complicated procedures. Among many methods of synthesis, electrochemical ones seem to be the extremely promising due to their simplicity, cost-effectiveness and easy possibility to scale up.

Among many different semiconductors, zinc oxide (ZnO) is very attractive material due to its unique properties like good photocatalytic activity, abundance in nature, low cost and environment-friendliness. Advantages mentioned above suggest that ZnO can be used in photocatalytic and photoelectrochemical applications. What is more, zinc oxide can be obtained in different nanostructured forms also by electrochemical methods [1,2].

Herein, we present some results of our recent studies on electrochemical synthesis of nanoporous zinc oxide layers by anodic oxidation [3]. Anodization of zinc foil was carried out in a 1 M sodium hydroxide electrolyte at the potential of 2 V and 4 V for 30 min. After the process, some samples were annealed in air at 200 °C for 2 h with a heating rate of 2 °C/min. The morphology of obtained zinc oxide was investigated by Scanning Electron Microscopy. The phase composition and crystallinity of as-obtained product, as well as the thermally treated layers, were examined by XRD

measurements. XPS spectra were recorded to confirm the product composition. Band gap values were estimated from UV-Vis reflectance spectra.

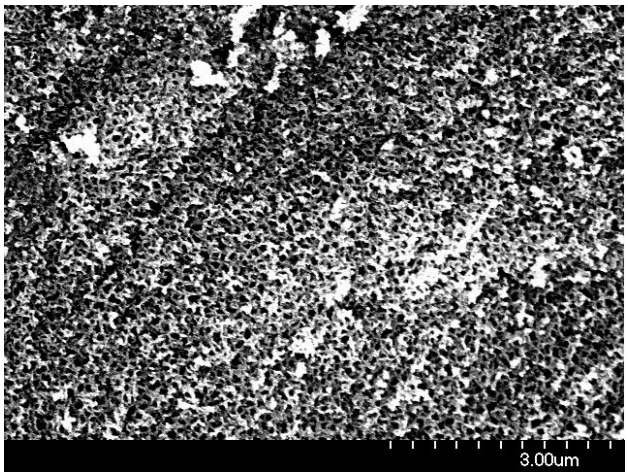

Fig. 1. FE-SEM image of ZnO layer obtained by anodization of Zn foil in a 1 M NaOH solution at 4 V for 30 min.

It was found that nanoporous oxide layers are obtained directly during anodization and there are no changes in the film morphology after thermal treatment. XRD and XPS measurements confirmed that the product of synthesis is crystalline ZnO. Annealing only improves the crystallinity of oxide. What is very interesting, it was confirmed that the band gap value of oxide layers is strongly dependent on the conditions applied during the synthesis.

References

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