

1D Zinc Nanostructures Obtained by Electrodeposition in Porous Titania

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The use of high-ordered porous templates on valve metals for formation of nanostructures via electrochemical deposition is a cheap and convenient method. Filling of the matrixes by other materials is applied to produce solid state solar cells, photodetectors, magnetic sensors, metal–insulator–metal capacitors[1]. Direct investigation of deposition and nucleation processes in porous templates is hindered because the interface is hidden. Besides, the diffusion limitations in the pores can create additional effects. However, deep understanding of the nucleation process and other processes, which occur in the beginning of the deposition, is extremely important because exactly in the beginning of the deposition it is easy to change properties and structure of the deposited materials.

In the current work, zinc electrodeposition from a deep eutectic mixture of ZnCl_2 and choline chloride/ethylene glycol on titanium covered by a dense and porous anodic titania film was studied.

It was shown that thin titanium dioxide layers work as high resistive media and the rate of zinc deposition decreases with film thickness. Thicker titania layers (23 nm and higher) have opposite properties and the zinc reduction rate starts gradually increasing with thickness.

The results firstly obtained on planar electrodes have been transferred to the non-detached porous anodic titania templates. Titania nanotubes were formed in ethylene glycol based electrolyte with ammonium fluoride. Matrix modification such as annealing and crystallization of the pore bottom have strong influence on the electrodeposition process and allow preparation of zinc coaxial structures or nanorods.

[1] D. Kannadassan, R. Karthik, M. Shojaeib Baghini, *Materials Science in Semiconductor Processing* **16** (2013) 274-281.