Electrodeposition of zinc nanoparticles in anodic aluminium oxide from ionic liquids

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The development of one-dimensional nanostructures is currently under active investigation for different applications. The areas that would benefit greatly from advances in the synthesis of well-defined nanostructures include photonics, nanoelectronics catalysis and biosensing. Metallic 1D nanostructures and their derivatives obtained by post-treatment are among the most interesting candidates for various applications including energy harvesting. The reactive metals such as Al, Mg and their alloys cannot be obtained via electrodeposition routes from aqueous solutions, but they can be electrodeposited from ionic liquids thanks to wide electrochemical window. Additionally ionic liquids have wide temperature ranges for the liquid phase, negligible vapour pressure and low pollutant emission. The electrodeposition of zinc and zinc alloys have been generally practiced from aqueous solutions with a wide range of additives. Nevertheless the small potential window and the hydrogen evolution are a drawback of this process.

In the present work the deposition of zinc nanoparticles inside pores of alumina based template from choline chloride eutectic solution containing $ZnCl_2$ was performed for the first time. This ionic liquid is known as water and air stable system. Electrodeposition of zinc in AC and DC mode was studied. Presence of zinc in the pores was confirmed by SEM/EDS and XRD. The metallic nanorods were converted to zinc sulphide and zinc oxide by the respective post-treatment stage. Both obtained compounds are known as semiconductors. Preparation of such materials in pores gives possibility to create a forest of semiconductive rods integrated in pores of dielectric oxide. The semiconductive properties of the obtained nanorods were also studied in the frame of present work.