Morphology of nanostructured thin films of ZnO fabricate from SILAR method

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The utilization of the ZnO in the nanotechnology is widely spread due to its superior properties, such as wide direct bang gap (~3.37eV), high exciton binding energy of 60 meV, non-toxicity and low cost [1]. The hexagonal crystalline structure allows obtaining a larger diversity morphologies and this allows its utilization in: UV lasers, piezoelectric crystal, chemical sensor, gas sensor, light emitting diode, photo detectors, and solar cells. One such morphology of ZnO thin film is the one-dimensional (1D) sub-micron rods or nanorods and nanowires, which has attracted interest due to a larger surface area and high aspect ratio. In the solar cell the ZnO has been utilized in the electrode for the dye-sensitized cell in substitution of TiO_2. In this study, ZnO nanostructured thin films were prepared by successive ionic layer adsorption and reaction (SILAR) on SnO_2-coated glass substrates [2]. In this procedure, the substrate is immersed in successive aqueous baths containing zinc nitrate hydrate and/or hexamethylenetetramine, hydrogen peroxide and triethanolamine. The pH solution was adjusted by addiction of ammonium hydroxide. At a low zinc nitrate concentration of 0.01M the surface is formed by individual nucleus. At a concentration of 0.02 M nanorod arrays were shown and this morphology is of special interest for solar cells application, but the deposition time used in this experiment was insufficient to promote the desired thickness. At a higher concentration of 0.03 M rice like branches morphology was observed but nanorods formation in the flowers was also present. The angular petals suggest that the growth was taken on polar face. For DSSCs applications the thin films prepared in 0.02 M solution was found to be the best choice.

References:

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