The Effect of Electrochemical Methods on The Shape of Zinc Oxide Nanostructures

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The ability to control and manipulate the physical and chemical properties of materials has been one of the challenging issues for chemistry and materials researchers. These properties are strongly related to two crucial geometrical parameters: size and shape. Now, chemists are exploring many ways to obtain such control at the nanometer scale. Various shapes of materials have been synthesized, such as nanotube, nanorod, nanobelt, nanoplate, and nanoparticles, flower-like pattern, etc. Recently, three-dimensional (3D) superstructures composed of 1D and 2D nanoscale building blocks have been the subject of increasing interest in material synthesis and device fabrication because of their unique collective properties and practice applications [1-3]. Self-assembly process is probably the simplest synthetic route to 3D superstructure[4].

Zinc oxide (ZnO), with a direct band gap of 3.37 eV and almost high exciton binding energy (60 meV) at room temperature, displays excellent piezoelectric, catalysis and new optical properties and has wide range of applications in optical and electronic devices [5,6]. It appeared as a promising semiconductor candidate for chemical sensors [7], field effect transistor (FETs) [8] and ultraviolet light emitting devices [9]. Also, ZnO is employed in solar energy conversion due to its stability against photocorrosion and similar photochemical properties as of TiO2 [10].

ZnO can be easily processed into various nanostructures due to its nature in chemistry. To date, numerous ZnO nanostructures with different sizes and morphologies such as nanowires, nanorods, nanotubes, nanosheets, polypods and nanohedgehogs and nanoflowers have been successfully synthesized through different methods. Recently, ZnO nanoflowers have been used for different applications such as photocatalytic, biomedical , electron emitter, field emission, and solar cells [11].

Zinc oxide (ZnO) has a large application potential owing to the diverse physical properties and the fine-tuning in the preparation process [12]. A variety of physical and chemical methods have been successively employed to fabricate ZnO physical methods like vapor-phase, thermal reduction, pyrolysis, chemical vapor deposition (CVD) and chemical approaches such as precipitation, high temperature hydrotermal synthesis and sol-gel, are very popular among all.

In this work, Zn metal was used as a working electrode in the electrochemical studies. Different electrolte solutions were tested for polarisation of Zn. Cyclic voltammetry (CV) and voltage controlled coulometry techniques were used as an electrochemical methods. Shape and size of ZnO, nanoflowers and nanopowders, can be easily controlled in our experiment conditions. The effect of applied potentials and tempatures on sizes and morphologies of ZnO nanoparticles have also been investigated. Moreover, anodization of a Zn foil was investigated method for producing various nanostructures of ZnO powder, in air atmosphere. ZnO nanopowders are synthesized with voltage controlled coulometry techniques in temperature controlled cells. Particles are characterized with scanning electron microscopy (SEM) , x-ray diffractometer (XRD).

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Figure 1. Scanning electron micrographs of ZnO obtained by electrochemical method in diffrerent experimental conditions.