Formation and Characterization of Ga Doped ZnO 1-D Nanostructures by Using Advanced Spray Pyrolysis Deposition Technique

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Introduction

Among many transparent conductive oxide materials, ZnO is one of the remarkable materials which has several alluring properties of high conductivity and transparency, direct wide bandgap (3.37 eV), high exciton binding energy (60 meV) at room temperature. Incorporation of a dopant such as Ga^{3+} could be enhanced its optical, electrical and thermal properties by generating extra electrons. Many researchers have found gallium has better properties as a dopant with ZnO, with respect to other dopants, as the ionic radius of Ga^{3+} is comparable with ionic radius of Zn^{2+}.[1] In this research, Ga doped ZnO 1-D nanostructures were synthesized by using the Advanced Spray Pyrolysis Deposition (ASPD) technique with rotational, pulsed and atomized modes.

Experimental

Glass substrates were ultrasonically cleaned by using ethanol, acetone and distilled water. Precursor solution was prepared by dissolving zincacetate dihydrate in 2-methoxyethanol. $Ga(NO)_3.xH_2O$ was added while stirring. Few drops of ethanolamine was added as a stabilizer. Solution was stirred for 1 h at 70°C. Finally, solution was aged for 48 h at room temperature. The 1-D nanostructures of Ga doped ZnO was prepared by using the ASPD technique. The apparatus is schematically drawn below.

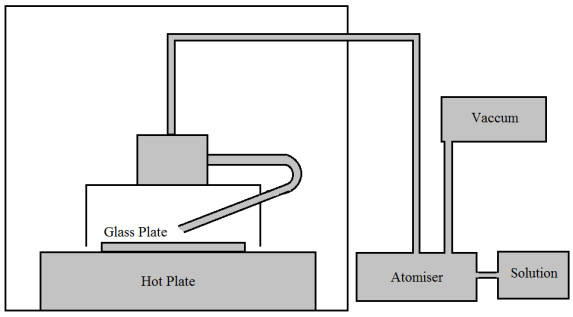

Fig 1: Schematic Diagram of Rotational, Pulsed and Atomized Spray Pyrolysis

Results and Discussion

Samples were characterized by using X-ray diffraction patterns, field emission scanning electron microscopy images and energy-dispersive X-ray spectroscopy. Further studies will be done by introducing them as working electrode of dye-sensitized solar cells to gain higher efficiency by increasing electrical conductivity and optical transparency.

References

1. Barbar, A. R., Deshmuk, P. R., Deokate, R. J., Haranath, J., Bhosale, C. H., Rajpure, K. Y., 2008, J. Phys., 41.