

Synthesis and Characterization of ZnO and Al Doped ZnO 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 enticing properties of high conductivity, high transparency, direct wide bandgap (3.37 eV), high exciton binding energy (60 meV) at room temperature, high availability, low cost and availability of many nano structures (nanoflowers, nanorods). Incorporation of a dopant such as Al^{3+} could be enhanced its optical, electrical and thermal properties by generating extra electrons¹⁾. Since nanostructures could be synthesized by many methods, spray pyrolysis is a prominent technique due to its tenuous activity. This deposition method has several advantages as it has many parameters such as nozzle height, deposition angle, rotation speed, number of rotations and interval in between rotations. In this report, ZnO seed layer and ZnO nanostructures were synthesized by using the Advance Spray Pyrolysis Deposition (ASPD) technique with rotational, pulsed and atomized modes.

Experimental

Glass substrates were ultrasonically cleaned by using ethanol, acetone and distilled water. Seed layer solution was prepared by adding zincacetate dihydrate to 2-methoxyethanol and ethanolamine. Then it was stirred for 20 minu at 60°C. Precursor solution was prepared by dissolving zincacetate

dihydrate in 2-methoxyethanol, ethanol and distilled water. $\text{Al}(\text{NO})_3 \cdot 9\text{H}_2\text{O}$ was added while stirring. Solution was stirred for 1 h at 60°C. Nanostructures of ZnO and Al doped ZnO was prepared by using the ASPD technique. The apparatus is shcematically drawn below.

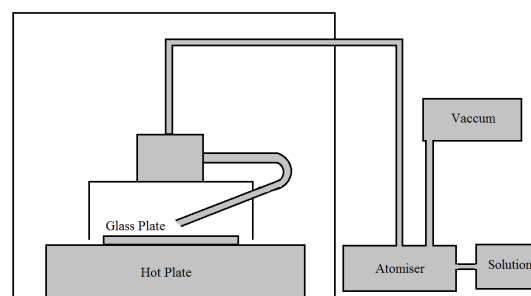


Fig 1: Schematic Diagram of Rotational, Pulsed and Atomized Spray Pyrolysis

Results and Discussion

Samples were characterized by using X-ray diffraction patterns, Fourier transform infrared spectra analysis and field emission scanning electron microscopy images. Further studies will be done by incorporating them as working electrode of dye sensitized solar cells to gain higher efficiency.

References

1. Mohammad Reza Khanlary et al., Properties of Fabricated Al Doped ZnO Nanorods by Spray Pyrolysis Method and Influence of Annealing Process On Their Properties, Int. J. Lat. Re. Sci. Tec. **2014**, 3 (5), 29-33.