Synthesis and Characterization of Ga Doped ZnO 1-D Nanostructures by Using Advanced Spray Pyrolysis Deposition Technique at Different Spraying Angles

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Introduction

ZnO is an n-type II–VI semiconductor material, with high conductivity, high transparency, direct wide bandgap (3.37 eV) and high exciton binding energy (60 meV) at room temperature. Due to those properties, ZnO is widely used in transparent conducting electrodes, field emission devices, chemical gas sensors, optoelectronic devices, piezoelectric devices, electrical and optical switching devices, flat screen displays and sunscreens. Incorporation of a dopant such as Ga^{3+} could enhance its optical, electrical and thermal properties by generating extra electrons. Ga^{3+} is known as one of best dopant of Zn^{2+}, as they have comparable ionic radii[1)]. In this report, Ga doped ZnO 1-D nanostructures were synthesized by using the Advanced Spray Pyrolysis Deposition (ASPD) technique with rotational, pulsed and atomized modes.

Experimental

FTO 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 used as Ga precursor. Solution was stirred for 1 h at 70°C and aged for 24 h at room temperature. Spray pyrolysis was done by changing annealing temperature, Ga concentration and spray angle.

Results and Discussion

XRD patterns confirms the presence of nano rod structure through a strong peak at 34º, which grows along a c-axis perpendicular to the substrate surface. FE-SEM images reveal that morphology of nano rods highly depends on the spray angle.

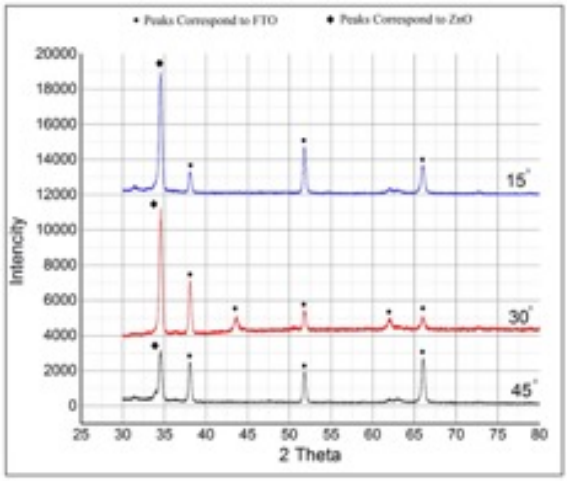

Fig. 1: XRD patterns of Ga doped ZnO 1-D nanostructure at different spraying angles

Conclusion

1-D nano structure was obtained at all spray angles. Favourable properties was observed at the sample which was grown at the spray angle of 15º.

References

1. C. Moditswe et.al., Highly conductive and transparent Ga-doped ZnO thin films deposited by chemical spray pyrolysis, Optik, **2016**, 127, 8317-8325.