Deposition and properties of ZnS :Mn thin films and nanostructured layers by spray pyrolysis.

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Summary

Mn doped ZnS thin films have been extensively reported in several fields of applications such as Solar cells, Electroluminescence devices, Flat panel displays. Deposition methods such as Chemical Bath deposition, Sol-gel technique, Sputtering amongst others have been used in deposition the ZnS thin film.

In this study, simple and cost-effective pneumatic spray pyrolysis set-up was used to obtain ZnS layers. Aqueous solution of $Zncl_2$ (Aldrich> 98.0% purity) and double recrystallized thiocarbamide (Merck > 98.0% purity) were used as precursor. To the best of our knowledge no publications on Mn doped ZnS nanorods by Chemical Spray Pyrolysis have been reported so far.

The aim of this thesis is to deposit and study the optical, structural, morphological properties of undoped and Mn doped ZnS thin films and nanostructured layer by chemical spray pyrolysis method.

According to SEM analysis very uniform ZnS films and ZnS nanostructured layer were formed. The XRD analysis and data revealed that independent of the morphology and the deposition temperature, all the obtained ZnS layers are highly crystalline along the (002) oriented axis with wurtzite type ZnS.

ZnS thin films (un-doped and 1% Mn doped) posess high optical transmittance approximately 80%. Films are more transparent when compared to ZnS nanostructured layers (65-70% optical transmittance). The energy band gaps obtained were close 3.66 eV independent of the morphology which is close to the theoritical Eg value for ZnS.

Finally, it was observed that dopant concentration of 3% Manganese was optimal for the preparation of highly luminescent ZnS nanostructured sample with intense red emission at 595nm (I_{red}/I_{NBE}= 14.5). Therefore, CSP is proposed as a suitable method for the deposition of Mn doped ZnS nanostructured layers which can be used as an electroluminescence device.