



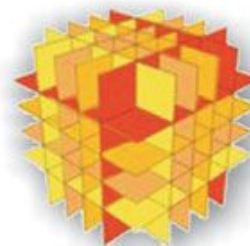
COPPER DOPED STRONTIUM SULPHIDE NANOPARTICLES FOR DISPLAY APPLICATIONS

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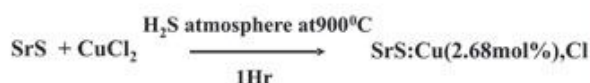


ABSTRACT

The structural, optical and photoluminescent properties of copper doped strontium sulphide nanophosphor and its difference from the bulk phosphor is reported. A wet chemical precipitation method with post annealing is presented for the synthesis of copper doped SrS nanocrystals while the bulk phosphor is prepared by solid state reaction. XRD studies reveal the phase purity of SrS particles with rocksalt structure. TEM images confirmed the average size of the nano particles as 8 nm. Green photoluminescence emission (PL) at 533 nm was observed for an excitation wavelength of 356nm, intensity of which for the nanophosphor is fairly greater than that of bulk. Blue shift in the absorption edge is observed for the nano particles due to reduction in particle size.

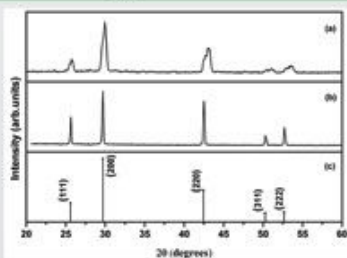
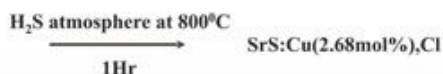
Experimental

Bulk SrS:Cu(2.68mol%),Cl → Solid state reaction



Nano SrS:Cu(0.2mol%),Cl → Chemical method

$\text{SrCl}_2 + \text{CuCl}_2 + \text{Na}_2\text{S}$ (dropwise with stirring) → Filtered powder



XRD patterns of (a) SrS:Cu nanocrystals prepared by chemical method (b) SrS:Cu bulk phosphor prepared by solid state reaction and (c) JCPDS data of pure SrS

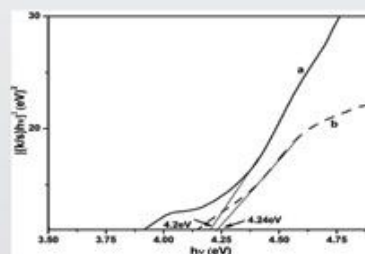
Characterization tools

Structural

Rigaku X-ray diffractometer
JEM-3000F, JEOL
ICP-1000IV, Shimadzu

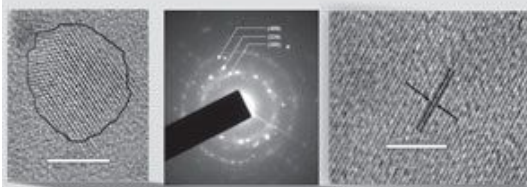
Optical

Spex-Fluoromax-3 Fluorimeter
Jasco-V-570 uv-vis-nir spectrophotometer

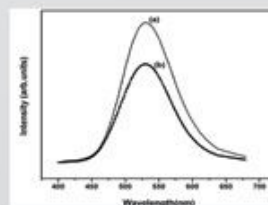


Plot of $h\nu$ versus $[(k/s)h\nu]^2$ of SrS:Cu (a) bulk phosphor and (b) nanoparticles

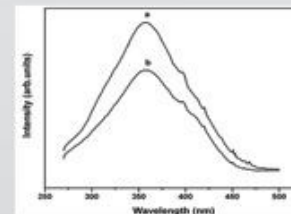
Band gap of nanoparticles blue shifts compared to the band gap of the bulk phosphor



TEM images of SrS:Cu,Cl nanoparticles. (a) shows particles with a diameter ~ 8 nm. (b) SAED pattern showing diffraction rings corresponding to (200), (220) and (400) plane, (c) HRTEM corresponding to (200) plane with a 'd' spacing of 3.007 Å



PL spectra of (a) SrS:Cu nanoparticles and (b) SrS:Cu bulk phosphor ($\lambda_{ex} = 356\text{nm}$)



PLE spectra of (a) SrS:Cu nanoparticles and (b) SrS:Cu bulk phosphor ($\lambda_{em} = 533\text{nm}$)

Conclusion

- ◆ Copper doped strontium sulphide nanophosphor was prepared by chemical precipitation method and its optical properties are compared with that prepared by solid state reaction.
- ◆ TEM images shows the average size of the nano particles as 8 nm.
- ◆ Blue shift in band gap is observed for the nano particles

- ◆ Intensity and line width of PL emission and excitation spectra for SrS:Cu nanoparticles are greater than that for SrS:Cu bulk phosphor.
- ◆ Reduction in crystal size prevents both radiative and nonradiative relaxation through unwanted competitive channels such as surface states and other impurities.

Strong green emission at 533nm was observed in both cases with the intensity and line width for SrS:Cu nanoparticles being greater than SrS:Cu bulk phosphor.