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EFFECT OF DOPING OF SR ON PARTICLE SIZE OF $Sr_XCu_{1-X}O$ USING IN XRD (X=0.1,0.3,0.5,0.7,0.9)

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ABSTRACT: Nano materials have wide range of applications due to their interesting size-dependent chemical and physical properties compared to particles of size in the range of micrometer. Metal oxide nanoparticles are very useful in field of sensing, optoelectronics, catalysis and solar cells due to their unique physical and chemical properties differing from bulk. Copper oxide nonmaterials have attracted more attention due to its unique properties. Cu_2O (Cuprous oxide) and CuO (Cupric Oxide) are two important oxide compounds of copper. Cuprous oxide is p-type direct band gap semiconductor with band gap of 2 eV and cupric oxide has a monoclinic structure and presents p-type semiconductor behavior with a Indirect band gap of 1.21–1.51 eV. They have lower surface potential barrier than that of metals, which affects electron field emission properties. [1-7] Strontium Oxide is a highly insoluble thermally stable source suitable for glass, optic and ceramic applications. Strontium oxide is a strongly basic, colorless oxide that forms elemental strontium when heated with aluminum in a vacuum. Here an attempt is made to synthesis (Sr_x $Cu_{1-x}O$) nanoparticles by sol–gel method. Five samples were prepared by changing concentration of strontium and their xrd is studied comparatively

KEYWORDS: nonmaterial's, XRD, FTIR, TEM, UV-VIS, band gap, strontium.

INTRODUCTION

In recent years, nanoscale metal oxides have attracted a great deal of research interest because of both fundamental and technological point of view. Among all the metal oxides, cupric oxide (CuO) has attracted considerable attention because of its peculiar properties. CuO has been used as a basic material in cuprate High-Tc superconductors as the super-conductivity in these classes of systems is associated with Cu-O bodings [8]. Apart from this, CuO has investigated as potential material for nanofluid in heat transfer applications [9] ,catalysts for the water-gas shift reaction, steam reforming, CO oxidation of automobile exhaust gases[10], photocathode's for photo electrochemical water splitting applications. For technological applications the detailed understanding of size, morphology controlled emergence of different properties are important. The synthesis procedure plays crucial role in controlling the size, shape of the nanostructure and hence detecting different properties of the materials. Cathode ray tubes in televisions are made of strontium, which are now displaced by other display technologies. Fireworks employ strontium salts to achieve a bright red color. Radioactive isotopes of strontium have been used in radioisotope thermoelectric generators (RTGs) and for certain cancer treatments. In nature, most strontium is found in Celestine. Strontium was named after the Scottish town where it was discovered. [11-16] . In the present study we have synthesized strontium doped copper oxide nanoparticles by sol-gel method by taking different concentration of strontium.

EXPERIMENTAL

All the reagents used were of analytical grade without further purification. .Strontium Nitrate [$Sr(NO_3)_2$], Copper Nitrate $Cu(No_3)_2$ $.3H_2O$ and Ethanol (CH_3CH_2OH) were used as raw materials and poly vinyl alcohol(PVA) as the sol-gel forming solvent.

MATERIALS AND METHODS

For synthesis **$Sr_{0.1}Cu_{0.9}O$.** We take 2.1163 g of Sr $(NO_3)_2$ and 21.744 g of $Cu(No_3)_2$ $.3H_2O$. We mix 50 ml of distilled water in 50 ml of ethanol and then add these two nitrates in this solution with constant stirring. Then we add 5g of PVA in this mixture. This mixture was then heated at 80^{o}C at magnetic stirrer. After some time of heating a gel starts to appear. The solution is heated till whole solution is converted in to gel. Then this gel is dried for 24 hrs and then crushed and calcinated at 400^{o}C.[18] The fine powder is taken out for characterization. Similarly we prepared other samples by varying concentration of strontium and copper oxide

RESULTS AND DISCUSSION

The typical XRD pattern of the $Sr_{0.1}Cu_{0.9}O$ nanoparticles annealed at 400°C is shown in Figure 1. The peak positions of the sample exhibited the monoclinic structure of CuO which was confirmed from the ICDD card No 801916. Further, no other impurity peak was observed in the XRD pattern, showing the single phase sample formation. The crystalline size was calculated using the Scherer formula,

$$D = 0.9\,\lambda/\beta\cos\theta \text{---------- (1)}$$

where λ is the wavelength of X-ray radiation, β is the full width at half maximum (FWHM) of the peaks at the diffracting angle θ. Crystallite size calculated by the Scherer formula was found to be 34.7 nm.

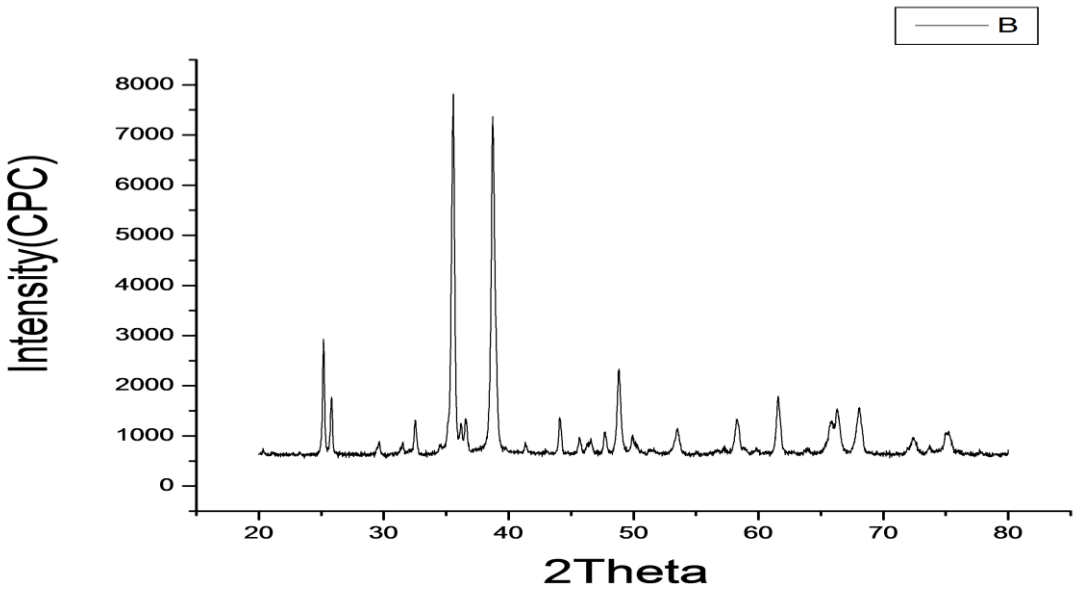

Fig 1:- Xrd of $Sr_{0.1}Cu_{0.9}O$

If we compare it with pure CuO XRD from the paper [17] then we get this type of curve as shown in fig.2**.**

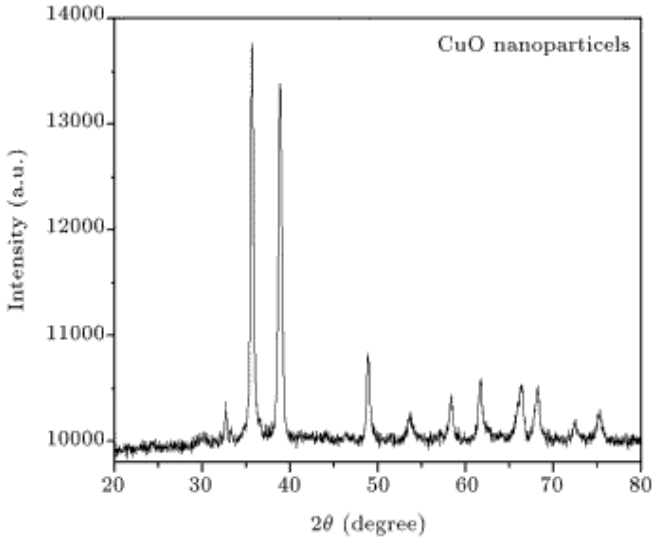

Fig 2:- XRD of pure CuO Nanoparticles

The XRD pattern of other samples are shown in below figure

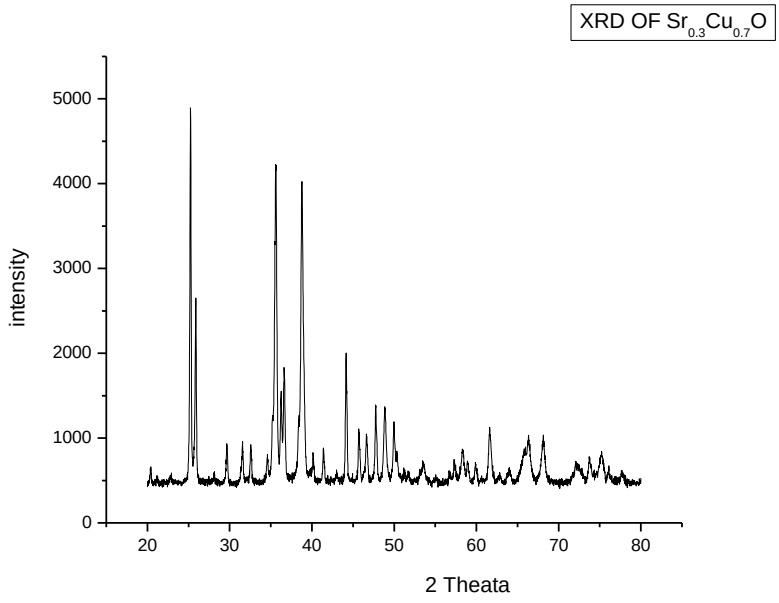

Fig 3:- Xrd of $Sr_{0.3}Cu_{0.7}O$

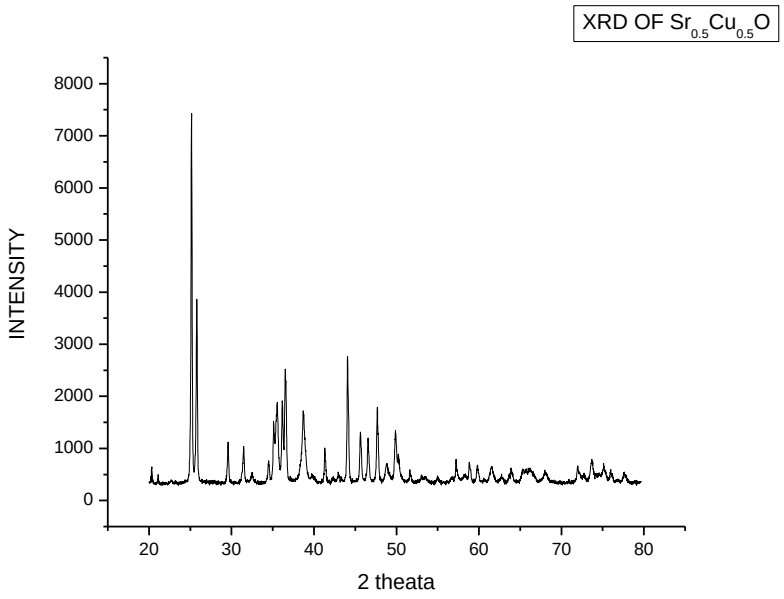

Fig 4:- Xrd of $Sr_{0.5}Cu_{0.5}O$

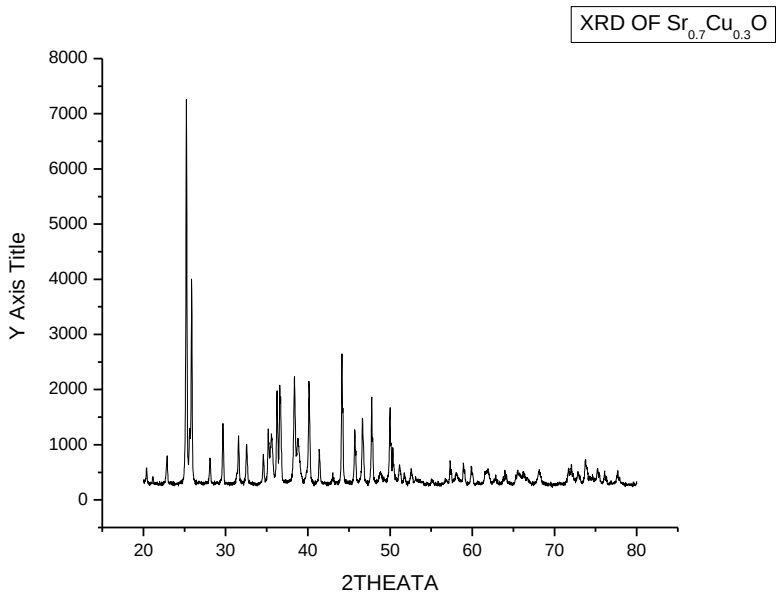

Fig 5:- Xrd of $Sr_{0.7}Cu_{0.3}O$

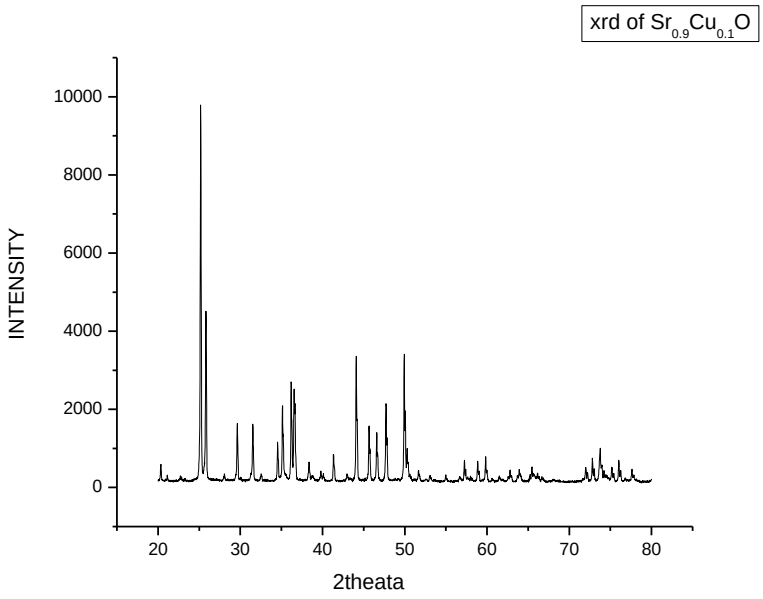

Fig 6:- Xrd of $Sr_{0.9}Cu_{0.1}O$

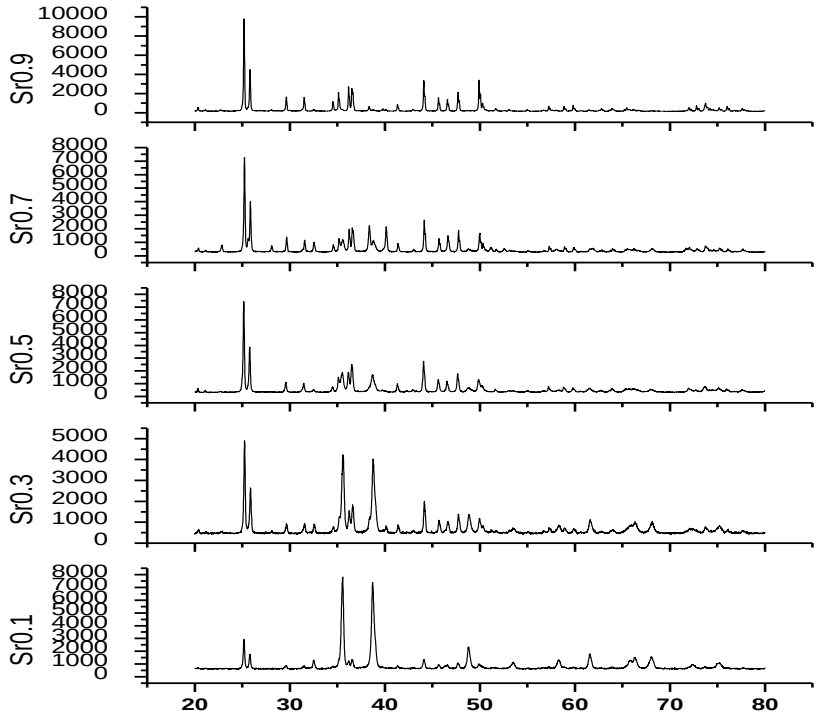

Fig 7:- comparative xrd of all samples

Table of comparison of various xrd parameters

Name of sample	2θ(DEGREE)	D(nm)	FWHM	Relative intensity	Particle size(nm)
Pure CuO	**35.5651**	**0.252222**	**0.2689**	**100.00%**	**31**
	38.7198	**0.232367**	**0.3700**	**72%**	**23**
$Sr_{0.1}Cu_{0.9}O$	**35.540**	**2.5239**	**0.251**	**100.00%**	**34.7**
	38.715	**2.3239**	**0.256**	**94.72**	**34.3**
$Sr_{0.3}Cu_{0.7}O$	**38.712**	**0.23241**	**0.254**	**100%**	**34.5**
	35.884	**0.25208**	**0.250**	**75.88%**	**34.9**
$Sr_{0.5}Cu_{0.5}O$	**25.159**	**0.35367**	**0.139**	**100%**	**61**
	25.783	**0.34525**	**0.130**	**54.27%**	**65.4**
$Sr_{0.7}Cu_{0.3}O$	**25.228**	**0.35272**	**0.116**	**100%**	**73**
	25.863	**0.34420**	**0.108**	**49.10%**	**78.6**
$Sr_{0.9}Cu_{0.1}O$	**25.177**	**0.35343**	**0.095**	**100%**	**89.9**
	25.818	**0.34480**	**0.095**	**47.79%**	**89.9**

CONCLUSION

With increasing the doping concentration of Sr we see that relative intensity of copper peak which lies around 35 degree decreases while that of Sr peak which lies around 25 degree increases. FWHM also goes on decreasing with increasing concentration of Sr. Particle size goes on increasing with increasing concentration of Sr. We see that as we increase the concentration of strontium, the size of nanoparticles increase which is obvious as radius of strontium atom are bigger then copper atom .we also conclude that sol gel method is a very nice and simple method to prepare these nanoparticles which are all crystalline in nature as obvious from xrd samples.

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