



Synthesis and Characterization of CdO-CuO Nanocomposite by Sol-Gel Method

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ABSTRACT

The CdO-CuO nanocomposite was synthesized by sol-gel pyrolysis method by using their respective nitrate. Method is very simple and low cost. Synthesized material was analyzed by XRD, FESEM, EDS and FTIR to get structure, surface morphology and bonding respectively. XRD and SEM result confirmed the synthesis of CdO-CuO nanocomposite. The crystallite size determined by Scherrer's formula was found to be 52.97 nm.

Keywords: nanocomposite, sol-gel, synthesis, morphology

I. INTRODUCTION

Nanoparticles have great attention toward their unique physical and chemical properties, which are different from those of either the bulk materials or single atoms [1]. In past years there are huge research on ZnO, SnO, etc., there were promising in their structure like spherical and rod later on developed into nanoparticle and nanorod for use in gas sensor. Now a day there is development into nanocomposite for better result. Semiconductor property with band gap of ~2.2eV shown by cadmium oxide (CdO) is an important nanoparticle with many applications like photocatalytic activity, gas sensing, optical property, storage of lithium batteries, etc [2-5]. There are different method for synthesis and characterization for CdO, PbO, ZnO, CdS, PbS and ZnS have been reported by many researchers [6-16]. Coupling of CdO with CuO has an enhancement in their structural property. CdO-ZnO synthesized by simple sol gel method [17] with reference to that CdO-CuO were developed.

In present work, CdO-CuO were synthesized by sol-gel pyrolysis method. The well crystalline and uniformly particle structure were observed in current synthesis method, Moreover

II. EXPERIMENTAL

Cadmium nitrate Hexahydrate from sd fine with AR grade and Copper nitrate Trihydrate from Merk with ACS grade were taken as source for synthesis while ethanol, water and alcohol is used as solvent to dissolve. For rigidity to gel network PVA (Polyvinyl alcohol) is used. Drying temperature is 110 °C and time for drying is 24 h. While synthesised solution was stirred by magnetic stirrer with Teflon coated magnetic paddle.

Ethanol is mix with distilled water and stirred up to 15 min with magnetic stirrer to get homogenous solution. Appropriate quantity of Cd(NO₃)₂·4H₂O, Cu(NO₃)₂·3H₂O and PVA were weighted by using electronic balance separately. Cadmium nitrate and Copper nitrate were added to solution and stirred continuously at temperature 70 °C after that PVA added to solution and stirred continuously upto 2 h. Viscous gel of solution was formed then kept in furnace for 24 h for drying. Obtained product was calcined at 350 °C in silica crucible. It is crushed with mortar and pestle to obtained fine powder of CdO-CuO nanocomposite.

III. RESULTS AND DISCUSSION

Figure 1 shows XRD (PANalytical Xpert Pro Cu Kα-1.54 Å) pattern of synthesized CdO-CuO powder

sample. Observed peak in XRD pattern are matching well with peak of JCPDS card no. 00-005-0640 (Monteponite sync CdO) and 00-005-0661 (Tenorite sync CuO). Characteristic peak of CdO-CuO have higher intensity shows crystalline nature of sample. From Debye Scherrer's Formula, average crystalline size of CdO-CuO nanocomposite is 52.97 nm.

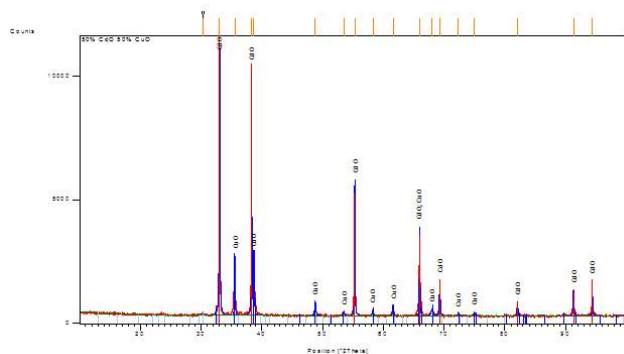


Figure 1. XRD pattern of CdO-CuO nanocomposite.

FTIR assessment from figure 2 was performed in region of 450 to 4000 cm^{-1} under normal condition of the solid CdO-CuO nanocomposite was recorded by FT-IR Spectrometer (Perkin Eimer instrument) shows in figure 2. The nanocomposite was mixed with KBr powder and spectra was measured.

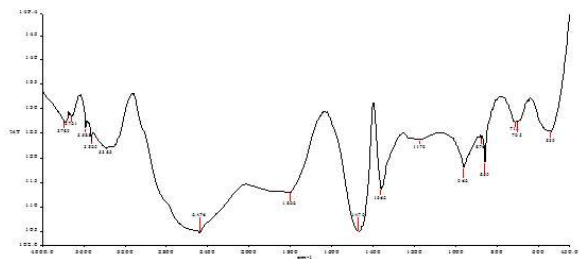


Figure 2. Fourier Transform Infrared detector FTIR spectrum of CdO-CuO nanocomposite.

FESEM is excellent application for study morphology of CdO-CuO nanocomposite. Fundamental nature and surface morphology of synthesized CdO-CuO nanocomposite was observed by FESEM (JEOL JSM7610F) equipped EDS (Oxford). Typical Surface micrograph of CdO-CuO nanocomposite were examined at low to high magnified range (figure 3 a-b). Crystalline size of CdO-CuO nanocomposite was measured from FESEM images in range of 39.7 to 132 nm. Crystal shape of CdO-CuO aggregated nanostructural material were displayed in FESEM images. FESEM images clearly indicate that prepared

material is nanocomposite of CdO-CuO, which is revealed in standard shape nanostructures.

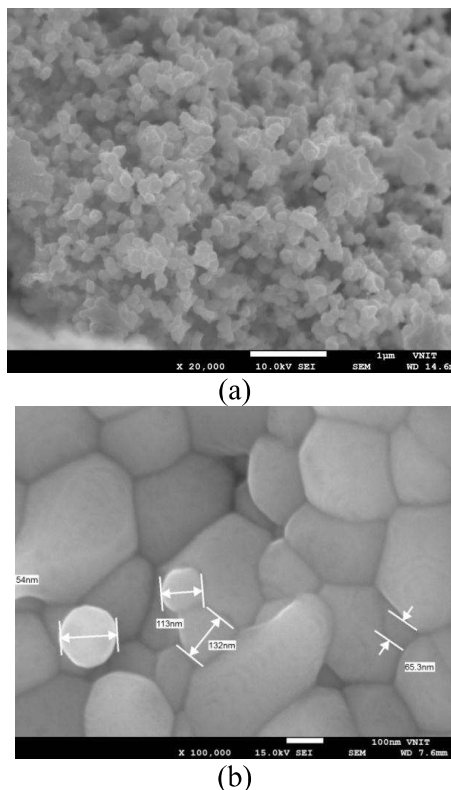


Figure 3. FESEM microstructure for (a) CdO-CuO microstructure at 20000 magnification, (b) CdO-CuO microstructure at 100000 magnification with grain size measurement

Based on the EDS(Oxford) analysis, Cadmium (Cd), Copper (Cu), and Oxygen were existed in synthesize material. Nanocomposite contains concentration of Cd, Cu and O in weight percentage is 42.9, 38.3 and 18.7 respectively (figure 4). There were no any additional peaks reported regarding that the impurities, shows that nanocomposite were composed of Cd, Cu and O.

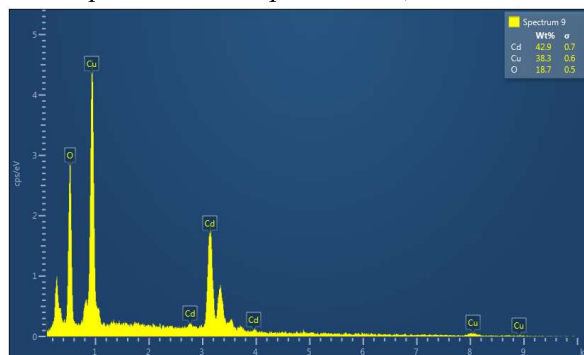


Figure 4. EDS spectrum of CdO-CuO nanocomposite

IV. CONCLUSIONS

CdO-CuO nanocomposite was prepared by using sol gel pyrolysis method. Material is developed with nanostructure properties and characteristics. In XRD analysis, observed peak are well matches with CdO and CuO peaks, so it indicate that material composed of CdO-CuO nanocomposite. Average crystalline size is 52.97 nm which indicate nanostructured nature of material. FTIR spectrum shows that observed absorption peak of CdO and CuO composite. When analyse with FESEM, particle are in nano meter range with crystal structure and standard shape. EDS report suggest that material include Cd , Cu and O element only. It can be clear that material is CdO-CuO nanocomposite.

V. REFERENCES

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