Examination the properties of doped copper oxide by silver: prepared chemical method

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Abstract. Copper oxide (CuO) have been formed by using simple chemical method, as Apure, and Ag doped copper oxide in different concentrations. Which examined the characterization by X-ray diffraction, and FTIR. The X-ray analysis detected that the three samples have poly crystalline structure, and FTIR revealed the compounds after doping wee homogenous.

Keyword: AgCuO, XRD, FTIR

1. Introduction
Copper oxides have extensively interest due to their unique properties which can improved or determined by synthetic processes. CuO employ extremely applications in superconductors, steam reforming, antimicrobial, humidity sensor, optical, catalysts for the water-gas shift reaction, and electrical technological6. [1-6]. Copper oxides can either be Cu2O or CuO and both of them p-type with a narrow band gap of about (1.2 up to 1.4 eV) at room temperature [7-15]. CuO synthesis techniques, solution based technique, hydrothermal, microwave and ultrasonic which have been expanded to fabricate well-defined nanostructures with different morphologies. The size, shape and morphology of the CuO nanostructures are highly influenced by different parameters such as concentration of constituents, temperature and aging time [16-19].

Manyasree D et al reported copper oxide is from the best antibacterial agent against both gram positive and gram-negative organisms [20]. Berra et al copper oxide nanoparticle can be fabricated by using a Phoenix dactylifera L leaf extract. This method is green and viable because of its ease, fast, low cost and friendly to the environment compared to other procedures [21].

In the present work studied the characterization of CuO and doped CuO by Ag in different concentrations 1% and 3%.
2. Materials and methods

2.1 Synthesizing the copper oxide nanostructure

Copper oxide was prepared by simple chemical method where 4.832 g of Nitrous copper nitrate Cu(NO₃)₂ was totally dissolved in 100 ml of distilled water by stirring for 5 min. blue solution was produced, and 0.64 g of NaOH also was dissolved in 40 ml of distilled water by stirring for 5 min, then the Sodium hydroxide solution was added drop by drop to the blue solution under stirring and left to mixed and stirring for 10 min. The solution was allowed to settle for few minutes the mixture was washed twice with distilled water, and one time with ethanol. the washed mixture was dried till it burned and turned to black, which was removed from the wall of the beaker and powdered by spatula. the powder hated for 4 hours at 600 ⁰C. the pure CuO was produced. The doped copper oxide with Silver AgNO₃ was prepared in same procedure Copper oxide was characterized by X-ray diffraction, and FT-IR

3 Result and discussion

3.1 X-Ray diffraction

XRD indicate if the nanomaterial are poly or single crystalline by using Sherer’s formula which gives the grain size [21] flowing as:

\[
\text{Grain size} = \frac{0.9 \times \lambda}{\beta \cos \theta}
\]

where \( \lambda \) is wavelength of X-ray diffraction and \( \beta \) is full width at half maximum (FWHM) of the peaks at the diffracting angle \( \theta \). In figure 1 The \( 2\theta = \)35.45, and 38.65, for pure, indexed as (002), (111) respectively [20], CuO nanostructure’s crystallite size is found to be 20.08nm.

![Figure 1: XRD for pure CuO](image-url)
For doped CuO with Ag at 1% concentrations, $2\theta=35.75$, and 38.95 indexed as $(1\ 1\ 1)$ and $(2\ 0\ 0)$ with average grain size equals to 22.7 nm, and for 3% concentration equals to 20.8 nm as show in figure 1, 2, and 3 respectively. All diffraction peaks were shown that typical poly crystalline structure as shown in figure 1, 2.

![Figure 2: XRD for doped 1%Ag](image2)

![Figure 3: XRD for doped 3%Ag](image3)
3.2 FTIR Measurement

Information about the chemical properties of a sample. The composition, structure, crystallinity, and chemical bounds. Fourier transform infrared spectra confirmed the formation of [1] pure cupric oxide (CuO) nanomaterial. Generally the peaks of figures 4, 5, and 6 have been surveyed in spectra, minutely the FTIR analysis showed different peaks at different wavenumbers (cm⁻¹). The peak at 533-581 due to vibrations of CuO, 876-1440 C–H , 1090 C–O and 1070 H–OH, in addition to the peaks from 1300 to 400 cm⁻¹ which are generated by the noise of the instrument.

![Figure 4: FTIR for pure CuO](image1.png)

![Figure 5: FTIR for doped 1% Ag](image2.png)
4. Conclusion
In this study we have report that preparation of CuO nanometrical by the solve thermal method which treated the solvents by heating, fore pure CuO and Ag dopped CuO with 1% and 3% molarities the products were produced as black powder which were heted about 600 OC for 4 hours and characterized by XRD and FTIRE. From the results of XRD it was observed that all products was a monoclinic.

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