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PREPARATION OF COPPER OXIDE IN DIFFERENT METHODS AND ITS CHARACTERIZATION

Abstract: *In this work, the copper oxide catalyst was prepared in several different methods(precipitation, hydrothermal and sol -gel).*

Then the prepared samples were described by Fourier Transform Infrared (FTIR) Spectroscopy.

Keywords: *copper oxide, precipitation, hydrothermal, sol –gel, IR.*

ПРИГОТОВЛЕНИЕ ОКСИДА МЕДИ РАЗЛИЧНЫМИ МЕТОДАМИ И ЕГО ХАРАКТЕРИСТИКА

Аннотация: *В этой работе катализатор на основе оксида меди готовили несколькими различными способами (осаждение, гидротермальный и золь-гель). Затем подготовленные образцы были описаны с помощью инфракрасной спектроскопии с Фурье-преобразованием (FTIR).*

Ключевые слова: *оксид меди, осадки, гидротерм, золь-гель, ИК.*

1. Introduction:

Metal oxides play a very important role in many areas of chemistry, physics,and materials science

[1].copper oxide is one of the transition metal oxides, and it has a more applications in many fields including catalyst[2] solar-energy conversion[3] **,**lithium ion batteries, magnetic storage, semiconductors, electrode materials, super hydrophilic materials[4], gas sensor[5], as antimicrobialagent, super capacitors[6]. Various methods have been used for synthesis of CuO Including precipitation method, sonochemical method, sol-gel method, hydrothermal method and chemical reduction method[7].

In this work, CuO was synthesized via precipitation method[8], hydrothermal method [9]and sol –gel method[10] All the methods is simple, highly efficient and low-cost.

2. Experimental details:

2.1. Preparation of CuO

2.1.1. precipitation method *of synthesis:*

CuO nanostructures were synthesized by precipitation method using copper acetate $Cu(CH_3COO)_2.H_2O$. First, each precursor was dissolved in 100 ml deionized water to form 0.1 M concentration. NaOH solution (0.1 M) was slowly dropped under vigorous stirring. Black precipitates were obtained and repeatedly washed by deionized water. Subsequently, the washed precipitates were dried at 60 °C for 16 h. Finally, the precursors were calcined at 350 °C for 4 h.

2.1.2. hydrothermal *method of synthesis:*

In a typical synthesis, 4 mmol of $Cu(CH_3COO)_2.H_2O$ was dissolved in 25 mL of distilled water . Reaction mixture was stirred for 15 min, followed by the drop-wise addition of 25 mL of aqueous NH3 (25%) under continuous stirring. Further, by the drop-wise addition NaOH (20 M) to the resultant reaction mixture, a blue precipitate was obtained. Reaction mixture was transferred into a Teflon-lined stainless steel autoclave, sealed, and maintained at 403 K for 4h. After the reaction, autoclave was cooled to room temperature. The resulting black precipitate was filtered and washed with distilled water. The product was dried in the air for 24 h to obtain the black CuO.

2.1.3. Sol-gel method of synthesis:

$Cu(CH_3COO)_2.H_2O$ (0.1M) is mixed with 100ml deionized water in 250ml beaker. The mixed solution heated at 80C with constant stirring, then 30ml of (pl-31) "m=0.5gr at 30 ml deionized water " is added to mixture of Copper acetate dehydrate solution.8M of sodium hydroxide NaOH pellet is mixed with 40ml of deionized water and heated 5min then taken in burette to be added drop wise in the mixture solution. The colour of mixture solution turned from blue to black immediately. The black precipitate is formed suddenly in the bottom of the beaker. Obtained black precipitate washed with deionized water. Subsequently, the washed precipitate was dried at 100 °C for 24Hrs. Finally the product was calcined at 500 °C, for 4Hrs.

2.2. Results and Discussion

Infrared Spectra:

Previous samples were studied using infrared spectroscopy, in which a very clear absorbance of the bond(O-H) at (3414 cm^{1-}) due to moisture was demonstrated **[Figure (1)]**.

We also notice how absorbance has significantly weakened at(3420 cm^{1-}) return to the bond(O-H), which indicates the hydrophobic character of the samples **[Figure (2)]**.

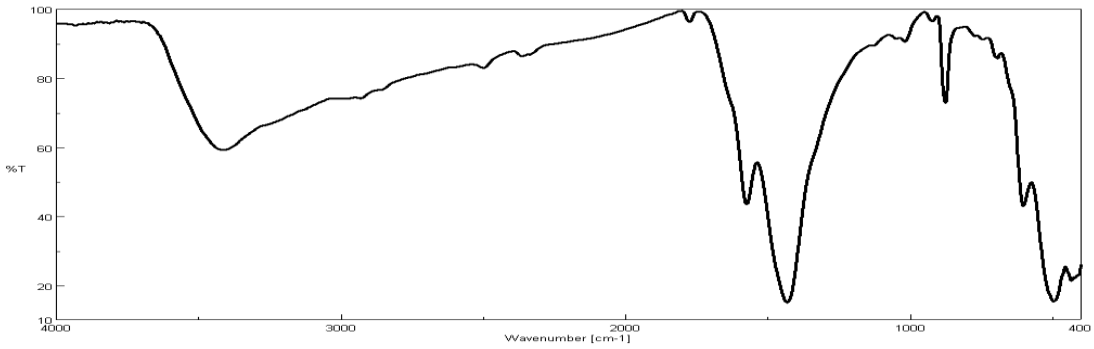

Figure (1): IR absorption spectra of CuO (hydrothermal method)

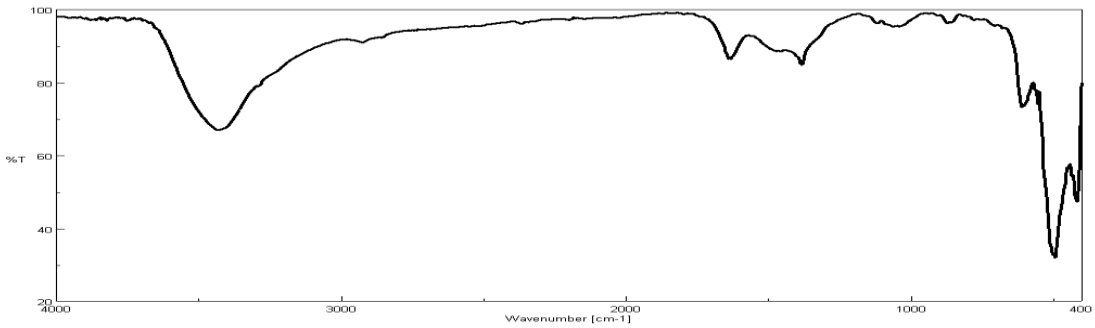

Figure (2): IR absorption spectra of CuO (precipitation method)

3. Conclusions

In this summry, the copper oxide catalyst was prepared in several different methods. Then the prepared samples were described by Fourier Transform Infrared (FTIR) Spectroscopy.

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