JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 1609 - 1612
https://publishoa.com
ISSN: 1309-3452

Preparation And Study of The Properties of Nano Structured Zinc Oxide Prepared by The Hydrothermal Method

Abbas. M. Ali Al-Kifaie ,[1]Abbas Hadi Abbas Al-Noamany,[2] Ban Hussein Ali [3], Ali Abid Abojassim[4]

University of Kufa, Faculty of Science, Department of Physics, Iraq
abbasm.alkifaie@uokufa.edu.iq

ABSTRACT

In this research reportspreparation, a novel of pure zinc oxide nanoplates using simple and low-cost Hydrothermal method. X ray Diffraction detection of ZnO wurtzite phase formation, fesem showed the formation of randomly oriented zinc oxide nanosheets, and haveaverage size of particles (62.82)nm and their crystal size ranges in the range of (62.82-26.80) nm. The energy gap value of ZnO is3.4 eV and the wavelengthvalueis247nm

Keywords: Hydrothermal method,zinc oxide nanoparticles powder,Fesem,X- ray Diffraction

1. Introduction

Increased interest in nanostructures that enable them to enter fields and applications. Stuck in the chemical, mechanical and planning industries [1]. The field of nanotechnology is a popular area of research and development in essentially all disciplines [2].Large height, light and excellent geological reactor, very small volume, high area, high width [3]. Among the most widely used nanomaterials, zinc oxide has increased the interest of the scientific and medical community for its use in biomedical applications and standards for bacteria, and its chemical and physical properties [4], such as its electrochemical elevation. The chemical correlation coefficient is high [5]. The oxide is classified a semiconductor within groups (VI-II) between ionic and covalent semiconductors. ZnO shows the structure of rock salt and wurzite (hexagonal symmetry) or (cubic symmetry), but ZnO crystals are more common and stable with the wurzite structure [7]. There are several different methods for preparing ZnO NPs, including physical and chemical methods such as chemical vapor deposition (CVD) , thermal evaporation, physical vapor deposition, solar solution gel deposition, electrochemical deposition and pulsed laser ablation[8].The hydrothermal method is one of the methods and the least of the methods is to prepare the methods by adding an amount of sodium hydroxide solution in drops to the aqueous flower acetate solution, after which the sediments are washed and filtered several times and then dried from time until a white precipitate of nano zinc oxide is obtained [3].

Zinc oxide is one of the most widely used semiconductors in different fields such as flat screen photovoltaic and photo catalytic displays. The oxide is a material with multiple properties and is suitable for high technology such as light-emitting diodes, photoelectric, photovoltaic and biological, solar node energy production, solar energy production, solar energy, electromagnetism, etc. High chemical and thermal stability, piezoelectric and piezoelectric properties [9].

2. Experiment setup

The materials that were prepared during the winter season have been prepared,were dissolved 2 g of [Zn $(CH_3COO)_2 2H_2O$]in 50 ml of DDW for 15 min using a magnet. 20 mL of NaOH was obtained at the same time. NaOH solution was added dropwise to the aqueous [Zn $(CH_3COO)_2$ $2H_2O$] solution. Under stirring for 20 min at 25ºC to produce a white gelatinous deposit. It was in an autoclave and placed in an oven at 170°C for 4 h. A precipitate is formed at the bottom of the autoclave and allowed to cool naturally to 25ºC. The obtained precipitate was centrifuged and rinsed with distilled water and ethanol three times to remove the sodium salt; the product was dried at 80 °C for 1 h with a hot plate to obtain ZnO nano-powder.

3. Results and discussion

A. X-Ray

Figure 1 and table 1 shows the XRD spectra of pure ZnO. The diffractionangles follows(31.708,36.195,47.487,56.561,62.823,67.916,69.038,72.518) for the preparation of zinc acetate, which are identical with Miller's coefficients in (100,101,102,110,103,112,201,004), which are identical to the standard database for zinc oxide (JCPDS No.fil 36-1451)) There is a widening of the peaks due to the purity of the material as well as the

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 1609 - 1612
https://publishoa.com
ISSN: 1309-3452

increase in the crystalline character, as there are no peaks that indicate impurities mentioned, and this information indicates the formation of the hexagonal structure of zincoxide, CrystalSize was calculated from the Scherer formula

$D= K\lambda/\beta\cos\theta$.....(1)

when D: is the grain size, λ: is the wavelength of Cu K (1.5406 Å),

β: full width at half

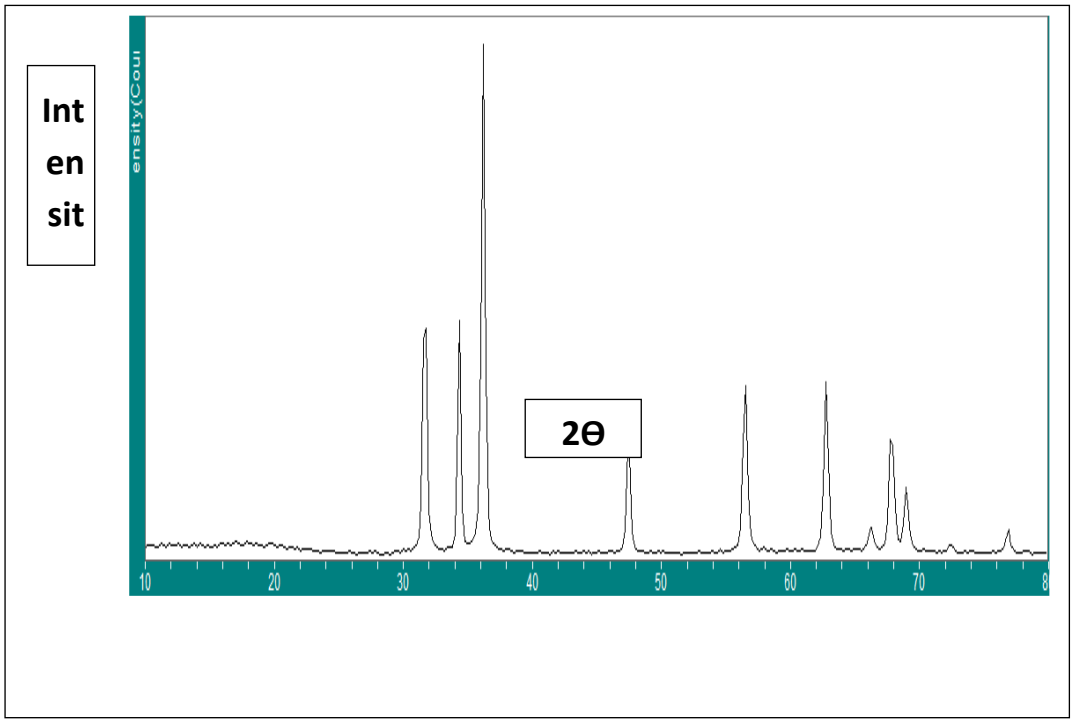

Figure (1) X-ray diffraction spectrum of ZnO Nanomaterial

Table (1) X-ray diffraction variables for ZnO

2Θ(deg)	FWHM	Crystal Size(nm)	d- pacing(nm)	Miller index
31.708	0.407	20.9	0.28196	(100)
36.195	0.329	26.7	0.24797	(101)
47.487	0.406	22.1	0.1913	(102)
56.561	0.375	25.0	0.16258	(110)
62.823	0.36	27.0	0.14779	(103)
67.916	0.38	26.2	0.1379	(112)
69.038	0.429	23.1	0.13593	(201)
72.518	0.346	29.7	0.13024	(004)

B. Field Emission Scanning Electron Microscope

The Fesem scanning of the prepared Zinc Oxide particles as shown in Figure (2) showed that they have a semi-spherical shape and the particles are lumpy, irregular in shape, with an average size of particles nm (62.88) and their crystal size ranges in the range of nm (62.88-26.80)

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 1609 - 1612
https://publishoa.com
ISSN: 1309-3452

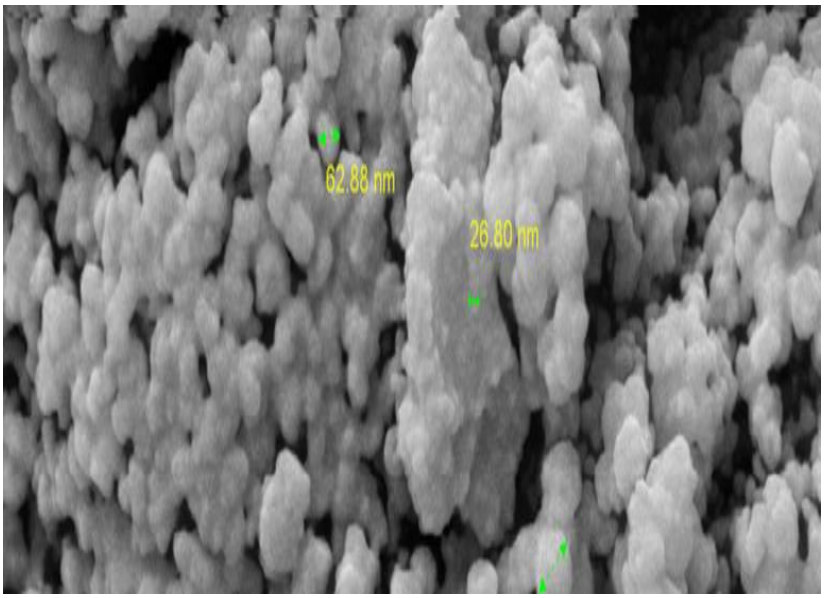

Figure (2): shows the FESEM of the ZnO nanomaterial

C. UV.DRS

Ultraviolet light spectroscopy (UV.DRS) was used to estimate the energy bandgap of ZnO. The energy bandgap of ZnO can be measured. using the wavelength and according to the following equation

$E_g=1240/\lambda$----------(2)

where E is the energy bandgap, λ is the wavelength at which absorption is effective. The power bandgap can also be calculated using the Tauc Plot curve using the following equation:

) $\alpha hv)^{1/2}(eV/cm)^{1/2}$---------- (3(

where α: is the absorption factor

h: is Planck's constant and is equal to $6.626*10^{-34}$ m^2. Kg/S

υ: is the frequency of light

Thus, the energy gap value of ZnO is3.4 eV and the wavelength value are 247 nm as shown in Figure (3a and3b)

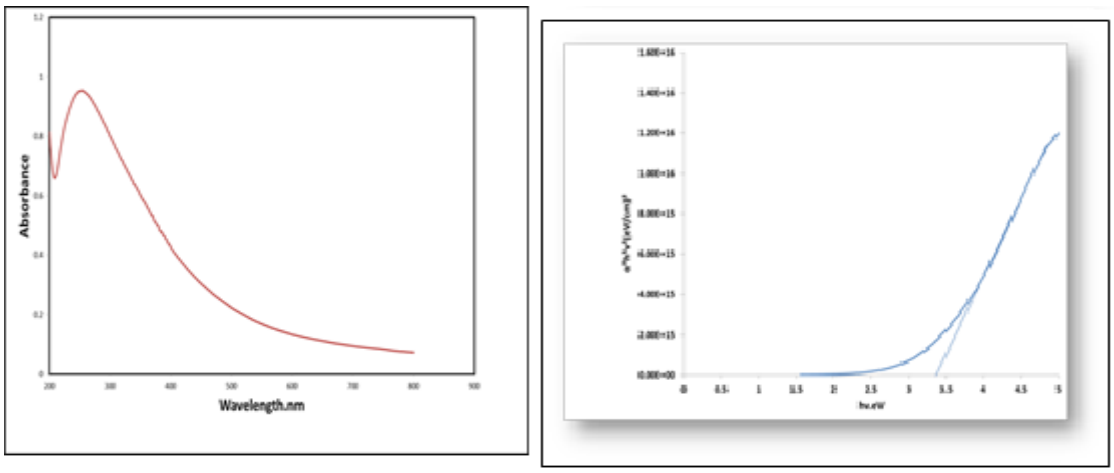

Figure (3) (a) shows the UV.DRS spectrum b) The energy bandgap of ZnO Nanomaterial

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 1609 - 1612
https://publishoa.com
ISSN: 1309-3452

4.Conclusions

To summarize, Zinc Oxide nano-sheets were successfully fabricated with low temperature and aqueous solution base method without calcination process. XRD results. The absorption edge is located under the ultraviolet rays and its diffuse peaks are associated with many of them

References

[1] Abinaya.C.,Marikkannan.M. , Manikandan.M., Mayandi.J., Suresh.P.,Shanmugaiah.V., Ekstrum.C., Joshua Pearce .(2016).Structural and optical characterization and efficacy of hydrothermal synthesized Cu and Ag doped zinc oxidenanoplate bactericides, 184, pp.172-182

[2] Mayes A. K., Hamida E. S., & Hanaa A. A. (2019). Adsorption of Albumin and Creatinine on ZnO Nanoparticles. International Journal of Pharmaceutical Quality Assurance, 10(04),PP. 689-695

[3] Noor, H. A., Mohamed, H., & Nehad, A. A. (2017). Preparation and Surface Modification of Zinc Oxide Nanoparticles. Journal of Babylon University, 25, 497503

[4] Kołodziejczak-Radzimska, A., & Jesionowski, T. (2014). Zinc oxide—from synthesis to application: a review. Materials, 7(4),PP. 2833-2881

[5] Lockett, A. M., Thomas, P. J., & O'Brien, P. (2012). Influence of seeding layers on the morphology, density, and critical dimensions of ZnO nanostructures grown by chemical bath deposition. The Journal of Physical Chemistry C, 116(14), 80898094

[6] Suhail, A. M., & Saeed, N. M. (2009). Preparation and properties of Nanostructure Zinc Oxide Thin Films. Iraqi Journal of Physics, 7(8), PP.75-81

[7] Chen, W. J., Liu, W. L., Hsieh, S. H., & Tsai, T. K. (2007). Preparation of nanosized ZnO using α brass. Applied Surface Science, 253(16),PP. 6749-6753

[8] Hahn, Y. B. (2011). Zinc oxide nanostructures and their applications. Korean Journal of Chemical Engineering, 28(9), 1797

.[9]Wahab, R., Hwang, I. H., Shin, H. S., Kim, Y. S., Musarrat, J., & Siddiqui, M. A. (2012). Zinc Oxide Nanostructures and their Applications. Intelligent Nanomaterials: Processes, Properties, and Applications, PP.183-212.