May - June 2020
ISSN: 0193-4120 Page No. 11058 - 11062

Synthesis and doping of (MPAMI) with CuO thin film by laser pulse deposition

Shimaa A. J. Farhan, Sahib Neamh Abdulwahid, Abid Allah M. Ali
University of Kufa, College of Education for Girl, Department of Physics, Najaf, Iraq

Article Info
Volume 83
Page Number: 11058 - 11062
Publication Issue:
May - June 2020

Article History
Article Received*: 19 November 2019*
Revised*: 27 January 2020*
Accepted*: 24 February 2020*
Publication*: 19 May 2020*

Abstract
Thin films of (MPAMI) and impurity were prepared by Cu Oxide (CuO) at a rate of (10%) on the bases of glass using the Pulse Laser Technology (PLD) and studying the effect of Impurity at Energy (1000mJ) on the structural properties of these films. X-ray diffraction. The hexagonal polymorphic membranes of hexagonal type with the growth of atomic crystalline direction 205) for both pure and impurity materials, and found that impurity leads to distinct homogeneity and convergence in the average crystal size of the particles. Copper caused the obtaining of somewhat homogeneous films, where it is noted that the convergence in values is clear, which is due to the effectiveness of the copper material in absorbing the laser energy and transferring it to the material. As for the results of EDX), it was demonstrated that no undesirable element and FTIR analysis had any clear changes in the location, shape and intensity of the beams.

Keywords: nanomaterials, pulsed laser, laser ablation thin film, Granular size

I. INTRODUCTION

The interest in studying thin films appeared by researchers since the second half of the seventeenth century, as many researchers studied the properties of matter and preparing it in the form of thin films due to its great importance in applied and theoretical research of solid state physics [1]. The term thin films are used to describe a layer or several layers of atoms on glass, metal, or plastic surfaces, sometimes not more than 1µm thick, be they blemished or unblemished membranes [2, 3]. As membranes are deposited on a substrate of glass, aluminum, silicon or quartz and others depending on the nature of the study or the scientific need and various scientific and technical applications have been used and the applications have a clear effect [4]. To know the possibility of using thin films prepared by the method of pulsed laser precipitation (PLD) Which is an important method of widespread use [5]. As Figure (1) shows the laser pulse that quickly heats the target material, causing a phase shift and generating waves with stress in the radioactive target. After that, the material begins to melt and turns into a gas phase, and this occurs during a very short period of time which leads to the generation of plasma. The laser beam will be absorbed by the plasma, causing attenuation in the intensity of the beam incident on the target. Also, due to ionization and excitation of the plasma field, the plasma expands and moves away from the reaction zone in order to reach the vitreous base and thin membrane formation [7].

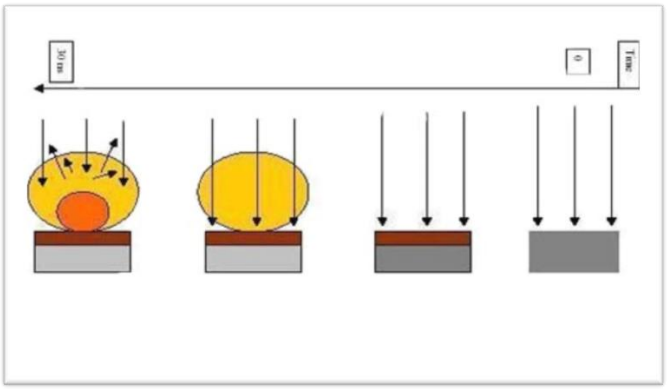


Figure 1. illustrates the process of laser ablation (PLD) [8]

II. Materials and Methods

In this study pure and impurity (MPAMI) membranes were prepared by CuO on a conductive glass plate using

Published by: The Mattingley Publishing Co., Inc.

May - June 2020
ISSN: 0193-4120 Page No. 11058 - 11062

a pulse laser deposition technique (PLD). The target material is placed at an angle of 450 in a high vacuum chamber with a pulsed laser. Target ions and atoms mutilated will deposit on the base. The surface of the base is permanently fixed parallel to the target surface, with a distance of 14cm. This is to get the best homogenization of the adhesion material on the glass floor. After evaporating from the tablets, leave (30) minutes to increase the adhesion of the material and under a pressure of discharge (1 x 10^{-3}) mbar. Where a Nd-YAG laser with a frequency interval of 10Hz and a capacity of (1000mJ) is used before and after deformation. The width of the pulses used for deposition was (6ns) and is constant for all membranes. The crystal structure of the MPAMI membranes has been studied using an X-ray diffraction device (XRD). The grain size (Gs) can be found using the Spark equation according to the equation [9]:

$$Gs = \frac{0.9\,4\lambda}{\beta \cos\theta} \ldots\ldots\ldots (1)$$

whereas: -

λ: X-ray wavelength (λ = 0.15418nm).

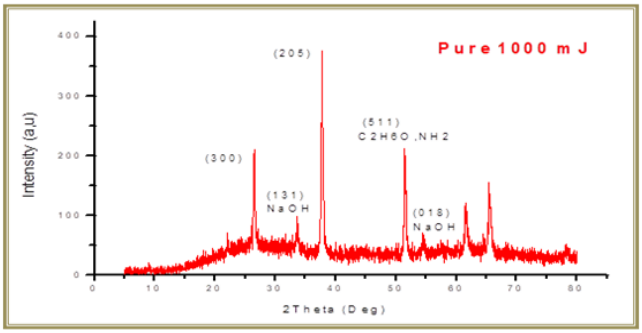
β: represents half width at the greatest intensity calculated from (FWHM * π/180)

ɵ: Barak diffraction angle (degrees).

Samples were examined by Emission Scanning Electron Microscopy Technology (FESEM). It provides two-dimensional images with high differentiation for the nature of the micro-structure of the membrane and the extent of the influence of energies on the surface shape, particle size and homogeneity. The energy dispersion spectroscopy (EDX) was used as it gives pictures of the energy spectrum distribution scheme for the elements. This work was done at Sharif University / Republic of Iran. The infrared spectroscopy (FT-IR), which indicates the proposed structures, was done in Kufa University / faculty of Pharmacy.

III. Results and Discussions

Study the crystal structure of Samples by X-Ray diffraction at room temperature in order to know the locations and intensity of the peaks. Where the research showed that the prepared membranes with a capacity of (1000mJ) have a multi-crystalline form of hexagonal type with atomic growth in a crystalline direction 205) of both the pure and impurity materials, which were found through good conformity with (JCPDS). The peak positions at the corners have been shown to the



crystalline nature of the MPAMI membranes. Figure (2) also show the presence of peaks at the angles (26.46 º, 33.611º, 37.7526º, 51.4758º, 54.5182º) and towards the growth direction of the granules (3 0 0), (1 3 1), (2 0 5), (5 1 1), (0 1 8), respectively.

Figure 2. MPAMI test prepared with 1000mJ energy by X-ray

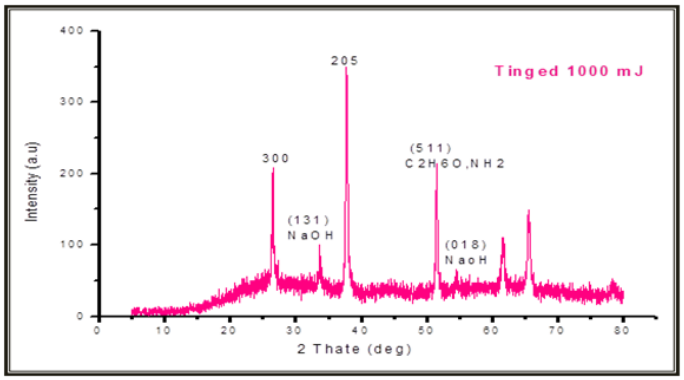


Figure (3) shows a significant change in the spectral beam width towards the increase and decrease in the intensity due to the impurity at the angles (26.46º), (33.611º), (37.7526º) and (51.4758º). Which is explained by the increase in the crystal density and homogeneity of the film with these values.

Figure 3. Impurity (MPAMI) test with 10% (CuO) concentration using X-ray

Also, an opposite behavior is observed at the angle (54.5182º), which showed two differences in the spectral beam width with the impurity process, which are explained by a decrease in concentrations and homogeneity at these values, as shown in Table (1).

Published by: The Mattingley Publishing Co., Inc.

May - June 2020
ISSN: 0193-4120 Page No. 11058 - 11062

Table 1. The difference between the results before and after the impurity for the X-ray diffraction

Energy (mJ)	FWHM (Deg)	G.S (nm)
1000 Pure	0.168	50.80093598
	0.384	22.60375568
	0.288	30.48698511
	0.288	32.02452697
	0.576	16.22563365
	0.336	28.78124471
1000 Tinged	0.192	44.54313988
	0.48	18.78503799
	0.288	30.48766934
	0.336	27.45585646
	0.576	16.78987785
	0.24	41.26325869

The recorded data shows that the average crystal size was uneven for the peaks recorded from the test before the tinged process where the data rate was as follows:

1. Sample (1) at 1000 mJ = 30.15384702 nm
After the tinged process, the average crystal size of the peaks recorded during the X-ray test (XRD) of the two samples was calculated, which showed distinct homogeneity and convergence in the average crystal size of the particles.
2. Sample (3) at 1000 mJ = 29.88747337 nm
It was found through practical results that increasing the laser pulse energy with the stability of other variables of the laser system (frequency, pulse width, beam diameter and exposure time) helps in obtaining nanoparticles.
The results show the thin films (MPAMI) and Tinged by CuO (10%) and prepared by Pulse Laser Deposition Technology (1000 mJ) for both models (pure, tinged), with a magnifying power of (140 kx), as shown in Figures (4, 5).

The recorded data shows that the average crystal size was uneven for the peaks recorded from the test before the tinged process where the data rate was as follows:

1. Sample (1) at 1000 mJ = 30.15384702 nm
After the tinged process, the average crystal size of the peaks recorded during the X-ray test (XRD) of the two samples was calculated, which showed distinct homogeneity and convergence in the average crystal size of the particles.

2. Sample (3) at 1000 mJ = 29.88747337 nm
It was found through practical results that increasing the laser pulse energy with the stability of other variables of the laser system (frequency, pulse width, beam diameter and exposure time) helps in obtaining nanoparticles.
The results show the thin films (MPAMI) and Tinged by CuO (10%) and prepared by Pulse Laser Deposition Technology (1000 mJ) for both models (pure, tinged), with a magnifying power of (140 kx), as shown in Figures (4, 5).

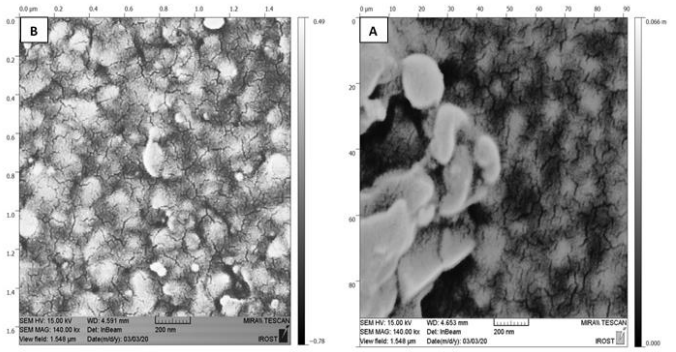


Figure 4. Thin film prepared by laser energy 1000 mJ (A) before tinged (B) after tinged

The thin membrane shape shows the heterogeneity in shape and the irregular masses are in the first case, which represents the non-tinged membrane. While we note in the form of the thin film prepared in the same conditions with the indication the disappearance of large forms and the formation of nanobodies and the occurrence of regularity in the general form of the membrane. Gwyddion Image Analysis and Calibration Program was used for the purpose of analyzing surface images of thin films. For the purpose of drawing a relationship showing the homogeneity of the formed surface, where irregular objects appear with distinct images. Figure 5 shows the analysis of the prepared film with a capacity (1000 MJ) in the pure and tinged cases.

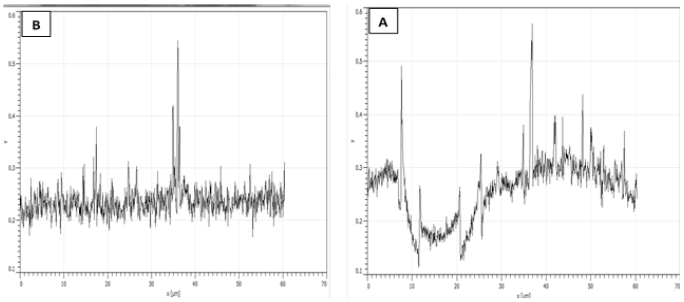


Figure 5. XRD for Thin film (A) before tinged (B) after tinged

Published by: The Mattingley Publishing Co., Inc.

May - June 2020
ISSN: 0193-4120 Page No. 11058 - 11062

Figures (4) and (5) show a significant match with the XRD tests, which showed that tinged helps obtain somewhat homogeneous films. Where it is noted that the convergence in values is clear, which is attributed to the effectiveness of copper in absorbing laser energy and transferring it to the material.

Through the energy dispersion X-ray detector (EDX) (attached to SEM), which is used to identify the elements involved in the composition of the material. The results shown in Figure 7 and 6 showed that the compound contains all the primary elements. Thus, it was confirmed that all the elements were present, which means that the sample did not change much during the preparation process.

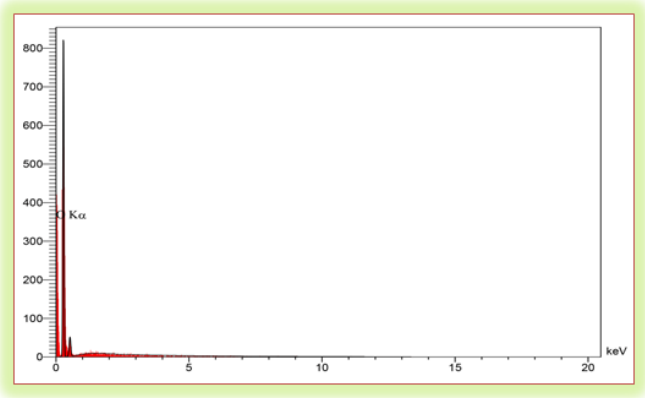


Figure 6. EDX examination of the MPAMI membrane before tinged with CuO

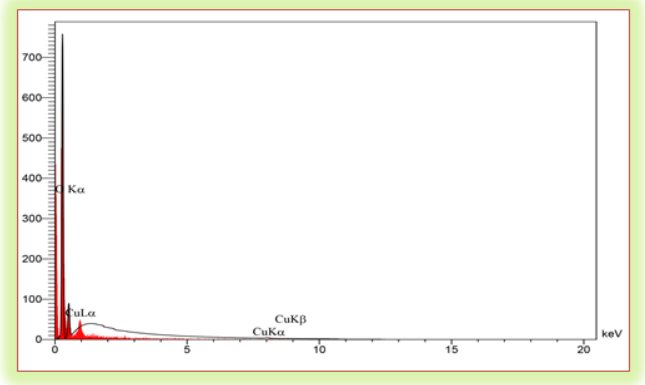


Figure 7. EDX examination of the MPAMI membrane after tinged with CuO

The examination was done for the membranes (MPAMI) by infrared and the results of the examination showed clear changes in the location, shape and intensity of the beams. Whereas, the impurity clearly affected the IR spectrum as in Figure (B). Where the azo group $\boldsymbol{v}$ (N = N) suffered from displacement at the power unit (1456 cm-1), and the isomethane group $\boldsymbol{v}$ (C = N) at the power unit (1510 cm-1), while the sphincter bundle $\boldsymbol{v}$ (N-H) appeared at Energy unit (3301 cm-1), and aliphatic and aromatic groups (C-H) did not suffer from obvious changes in location, shape and intensity because they were far from the location of tinged.

Figure 8. Infrared spectrum for membrane)MPAMI(

Figure 9. Infrared spectrum for membrane (MPAMI) tinged with CuO

IV. CONCLUSION

In this research, good results were obtained through X-ray examinations. The prepared films (MPAMI) and films deposited on glass tinged by (CuO) with a multi-type hexagonal composition with atomic growth in the crystal direction (205) have designed. Where the copper oxide (CuO) was 10% positive side for the formation of homogeneous nanofilm that is due to the high voltage function of the material. Scanning emitters of the electron microscope have shown that impurities help to obtain somewhat homogeneous films.

Right now, future a novel methodology for expelling substantial blast with undermined pictures where parametric

Published by: The Mattingley Publishing Co., Inc.

May - June 2020
ISSN: 0193-4120 Page No. 11058 - 11062

REFERENCES

[1] C. Ratsch, J.A. Venables. Nucleation theory and the early stages of thin film growth. Journal of Vacuum Science & Technology A: Vacuum, Surfaces, and Films, (2003).

[2] JefPoortmans, Vladimir Arkhipov. Thin Film Solar Cells: Fabrication, Characterization and Applications. John Wiley &Sonspublications (2006).

[3] Uhuegbu, C. Chidi. Growth and Characterization of Lead Sulphide Thin Film for Solar Cell Fabrication. Canadian Journal on Scientific and Industrial Research Vol. 2 No. 6, 2011.

[4] Al-Assiri, M. S., Mostafa, M. M., Ali, M. A., & El-Desoky, M. M. Synthesis, structural and electrical properties of annealed ZnO thin films deposited by pulsed laser deposition (PLD). Superlattices and Microstructures 75 (2014): 127-135

[5] Abed Ahmed Khalefa AL–Hammdany. Study the structural, optical and electrical properties of 〖Li〗_x 〖Ni〗_(2-x) O_2 Compound and thin films prepared by pulse laser deposition and use as a gas sensor " University of Tikrit, Faculty of Education and Pure Sciences, 2017.

[6] Mustafa, DhiaAldinSleibi, and RawaaIsam Mohammed Al-Rawi. Structural and Optical Properties for Zn Doped CdO Thin Films Prepared by Pulse Laser deposition. Iraqi Journal of Science 59.2B (2018): 839-846.

[7] Harb, Noha H. The Structure and Optical Properties of Ag doped CdO Thin Film Prepared by Pulse Laser Deposition (PLD). Baghdad Science Journal 15.3 (2018): 300-303.

[8] Al-Samarai, Abdul-Majeed E., Zuheer N. Majeed, and Ghuson H. Mohammed. Effect of SiO2 ratio on electrical Properties of SiO2: ZnO Thin Films Prepared by pulsed laser depositions (PLD) technique. Tikrit Journal of Pure Science 23.10 (2019): 76-80.

[9] Yan, Zhong, et al. Impacts of preparation conditions on photoelectric properties of the ZnO: Ge transparent conductive thin films fabricated by pulsed laser deposition. Journal of Alloys and Compounds 812 (2020): 152093.

[10] Yasar, Mustafa, and . 2019. The remember regeneration therapy method: An overview of new therapy protocol to approach diseases. Journal of Complementary Medicine Research, 10 (1), 68-80. doi:10.5455/jcmr.20181229122909

[11] Zeb, I., Ahmadi, N., Nasir, K., Kadakia, J., Larijani, V.N., Flores, F., Li, D., Budoff, M.J.Aged garlic extract and coenzyme Q10 have favorable effect on inflammatory markers and coronary atherosclerosis progression: A randomized clinical trial(2012) Journal of Cardiovascular Disease Research, 3 (3), pp. 185-190. DOI: 10.4103/0975-3583.98883

Published by: The Mattingley Publishing Co., Inc.