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Calculating the Nanometer Diameters of The Grains Zno: SnO_2 Composite Depending On The SEM Image Analysis

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Calculating the Nanometer Diameters of The Grains Zno: SnO_2 Composite Depending On The SEM Image Analysis

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ABSTRACT:
In our research, were prepared ZnO: SnO_2 composite thin films from compounds mixed according to proportions volumetric (20, 40 ,60 and 80) % specific proportions, and then we obtained microscopic images of them using the scanning electronic microscope(SEM), scanning with Nano and micro diameter .The images and scaled and their measurements worked filter from impurities and obstacles to obtain the largest possible information about the surface of the thin film and distribution the numbers and areas of the thin film grains according to the most accurate measurements, then used thresholding for images to isolate the original compounds of the composite thin film and know their numbers, areas, sizes and all information related to the compounds that make up the film. From the data and all the information we concluded that the number of grains in the Nano diameter is greater than the micro diameter but the areas and sizes in micro measurement is greater than Nano measurements, as well as the distribution of the nano range diameter greater than the distribution of the micro range diameter.

KEYWORDS : *Image Filtering, Distribution; Grains, diameter Range, Particle Isolating.*

1.Introduction

Thin films have been widely used in different researches and applied fields, such as engineering of chemistry energy, biotechnical, medicine instruments, and military manufacturing. Extraction and separation the particles are two major applications of surface membranes. [1-4]. The field of digital image processing has grown rapidly and now, where techniques are used and different methods and the multiple purposes of improving the information image for interpretation and analysis, given the importance of these images and its wide spread use in many areas of daily life for humans, for example in the field of medicine using these technologies for improved picture X-Ray images and ultrasound in the military to improve the thermal images and X-Rays, infrared and radar images, also used to improve the space and aerial images and pictures of finger prints and photographs used in the process of mineral exploration using seismic waves[2,3].

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2. Literature review

G. C. Keerthi Vasan : Gas- Liquid flows are by far the most important type of multiphase flow. This can be attributed to the wide range of industrial applications that the gas-liquid flow is discerned in. Popular examples of Gas-liquid flows are oil-gas mixtures, evaporators, boilers, condensers, refrigeration and cryogenics. The measurement of the liquid film thickness in two phase flows is prominent in various heat and mass transfer applications such as in boilers. To determine the thin film thickness is the aim of this study. A glass tube of diameter 4.7 mm is used for conducting the experiment and a laser pointer is used to obtain an image pattern on the screen. Using the principles of Optics, a method has been proposed to determine the thin film thickness and also to characterize the different types of flow. The thin film thickness obtained in the proposed method is validated using image processing[5].
Cristina Ponte Lira: provides a new process for the computation the grain sand size based on image operations. Size distributions for image surfaces are obtained with successive morphological openings parameterized by structuring elements of increasing size [6].
Li Xin Zhang,et al: used an efficient method to calculation the grain size for the 7050 Al-alloy samples. they are depending on advance algorithm is different The traditional methods of computation the grains size [7].

3. EXPERIMENTAL

3.1 Zno:SnO_2 Composite thin film preparation

To prepare the diaphragms of the mixture between the two subjects, the same articles were used, according to proportions (20, 40 ,60 and 80) % of the additive from (SnO_2) to the host from (ZnO). Without a change in the standard, put the mixture in a vial Volumetric capacity (100ml) and mix well for an hour by magnetic mixer until it becomes The solution is clear, plankton-free and homogeneous, and then finally placed in the apparatus reservoir, for it to become Ready to spray.

Thin films were prepared in this way by spraying the solution of the salts of the substance from which the membrane was prepared On hot bases, at 400 ° C, the thermal decomposition of solid compounds formed on the surface of the hot base is given to produce products. Chemically stable. One of the important and effective methods in preparing a chemical spray method is to prepare it. Thin films are used in many industrial applications such as the manufacture of solar cells[10,11].

3.2 Image Acquisition

The image acquisition represents in computer as a matrix in two dimensional space [1]. Each element position is called as pixel, therefore the digital images are consisting of number of pixel with size (NxM). A digital image is a rectangular array of pixels also called as bitmap with color value [12,13].

Digital images were acquired in gray level type, with a size (512x 572) pxl , 16 bits/pxl and saved in TIf format (Fig.1 and Fig.2). Our aim of Image acquiring is to transform SEM image into an array of numerical data which could be later manipulated on a computer, [14].

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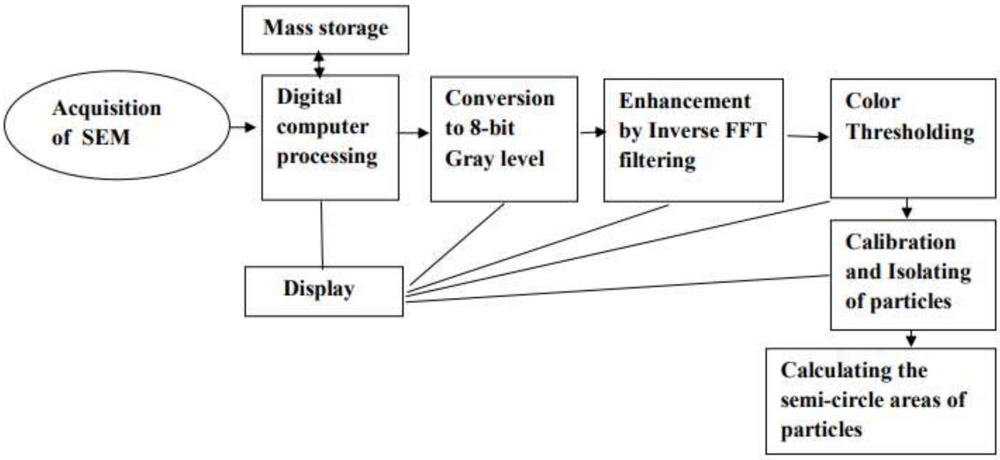
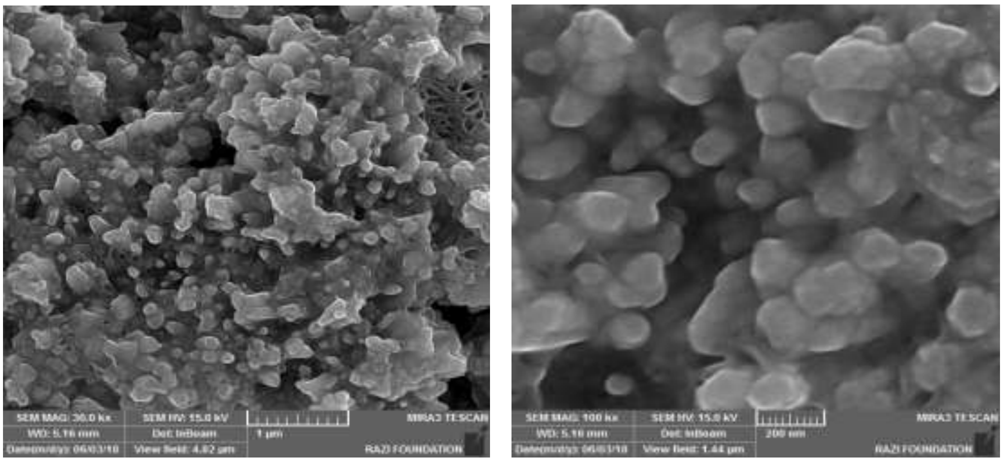


Figure (1) Shows the main scheme to the studying the distribution of the grains.

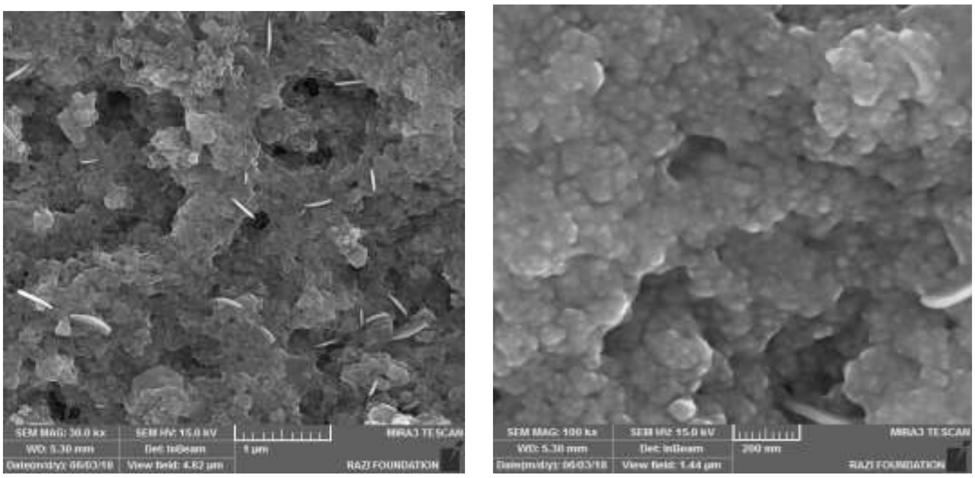
In our work obtained the surfaces of thin films mixed with different proportions of the two compounds taken with the scanning electron microscope images. Figure (1) shows The framework of the project. Figure (2,3) shows the images of the scanning electron microscope (SEM) of the surface of the Zno: SnO_2 thin films prepared by mixing different proportions of the two compounds (20, 40, 60 and 80%) with nanoscale and microwave measurements.

After we obtained images from the scanning electron microscope, we set scale the image measurements by micro and nanoscale measurements (pixels per nanometer or micrometer) after they were (pixels per inch)



a b

Fig. (2). Represents the surface images(SEM) of Zno(80%) : SnO_2(20%) composite thin film: a)1µm b)200nm



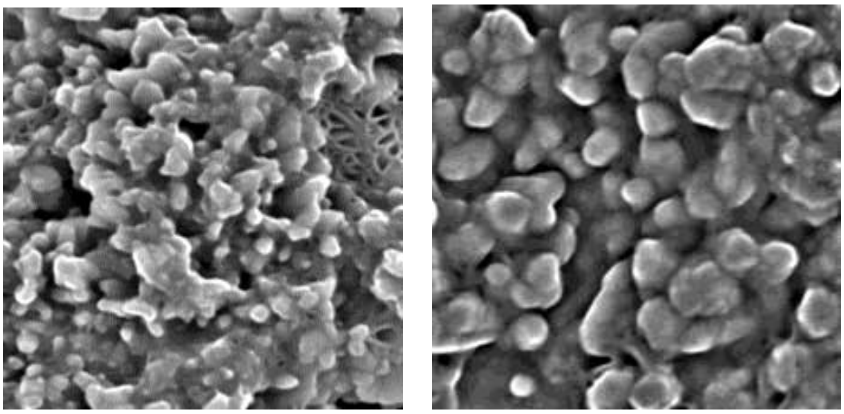
a b

Fig. (3). Represents the surface images(SEM) of Zno (40%) : SnO_2(60%) composite thin film: : a)1µm b) 200nm

3.3 Image filtering

Image filtering techniques used for image smoothing and it is one of the most important and widely used operation in image processing. Variations in illumination or poor contrast that may be dealt with in early stages of image processing [14]. The Purpose of smoothing is to reduce noise and improve the visual quality of the image. -algorithms are used for filtering the images. Image filtering makes possible several useful tasks in image processing. A filter can be applied to reduce the amount of unwanted noise in a particular image. Another type of filter can be used to reverse the effects of blurring on a particular picture and enhance the digital image by using image enhance contrast method. [8,9, 16]

There are many methods are there for removal of blur caused by motion to be a special case of inverse filtering from images. In our work were applying the inverse FFT, is a special case of the Fourier transform for Filtering by using band pass filter to enhancement the images and increase the quality of the images [17]. figures (4, 5) show the pictures after the filtering and improving their quality.



a b

Fig. (4). Inverse FFT filtering of images(SEM) of surface Zno(80%) : SnO2(20%) composite thin film: a) 1µm b)200nm.

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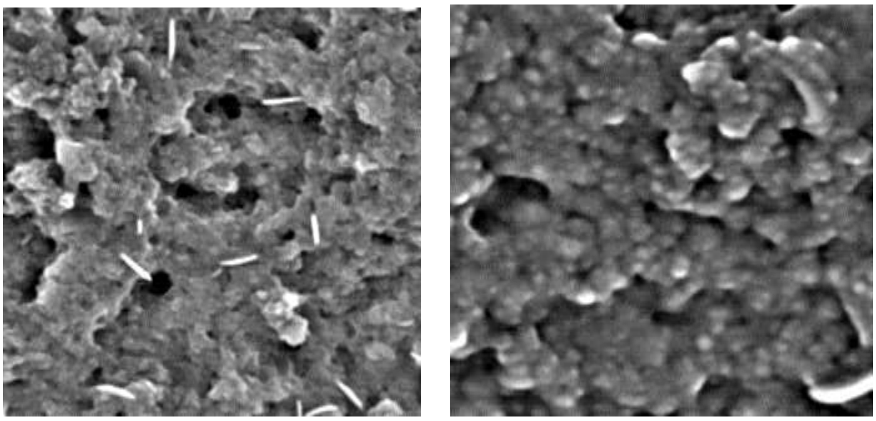


a b

Fig. (5). Inverse FFT filtering of images(SEM) of surface Zno(80%) : SnO2(20%) composite thin film: a- 1µm b- 200nm

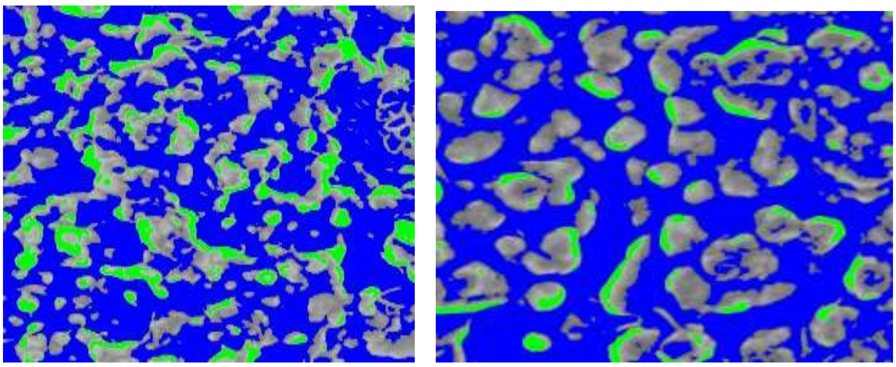
3.4 Isolation of grains of the composite components

3.4.1 Thresholding

Thresholding is initially directly and important to detected in a gray level histogram of an image, which is play a main role in segmentation and isolation the regions based on pixel intensities [18,20]..

The gray levels of pixels belonging to the zoning are different from the gray levels of the pixels belonging to the another zoning. Thresholding then becomes a simple but effective tool to separate objects from the background[9].

In this work were convert the image with gray scale (16 bits) to the grayscale (8bits) and isolate the original components (grains)of the component consisting of Zno:SnO_2 composite thin films through the image threshold of the images and the figures (6,7) show the images of thin films after isolating the two compounds by determine gray color and green color in them according to the original proportions.



a b

Fig. (6). Isolated the grains of the particles Zno(80%) : SnO_2 (20%) composite thin film: a) 1µm b) 200nm

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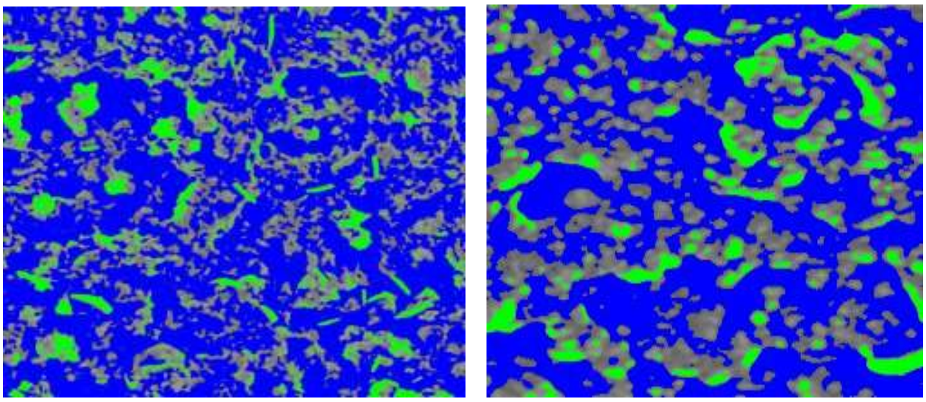


a b

Fig. (7). Isolated the images(SEM) of surface Zno(80%) : SnO2(20%) composite thin film : a-)1µm b)200nm

4. Results

4.1 Calculation areas of grains:

The grains size and distribution of nanoparticles and micron meter can be determined by using analysis the surface SEM images. There are two basic methods of defining particle size, the first method is to set the particles and make actual measurements by microscopic techniques measure many dimensional parameters for image. The another method effort the relationship between particles behavior in similar properties [21]. The images were obtained and processed it formally and isolated the areas of the grains for each of the two compounds, we also calculate the distribution of the granular areas of each compound on the surface according to the specified proportions and according to the following drawings**.** The particles number, average sizes, mode, and median are showing in the tables (1,2,3,4) according to the measurements given

Table (1): The data of isolate grains of ZnO(80%) :SnO_2(20%) in (µm).

Composite thin film	**Slice**	**Count of grains**	**Total Area (µm)**	**Mean (µm)**	**Median (µm)**	**Mode (µm)**
ZnO(80%)	**1 µm**	**91**	**83618**	**918.8**	**720**	**504**
SnO_2(20%)	**1 µm**	**22**	**1089**	**49.5**	**50.5**	**22**

Table (2): The data of isolate grains of ZnO(80%) :SnO_2(20%) in (nm)

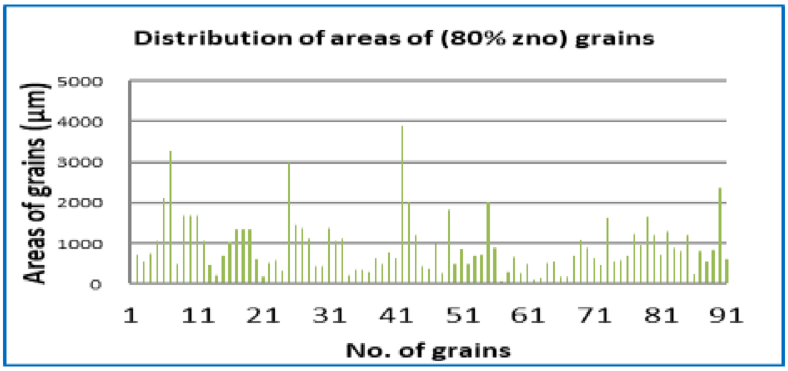
Composite thin film	**Slice**	**Count of grains**	**Total Area (nm)**	**Mean (nm)**	**Median (nm)**	**Mode (nm)**
ZnO(80%)	**200 nm**	**57**	**166303**	2917.6	**2646**	**2520**
SnO2(20%	**200 nm**	**33**	55052	**1619.2**	**1478**	**748**

Table (3): The data of isolated particles of ZnO(40%) :SnO2(60%) in (µm).

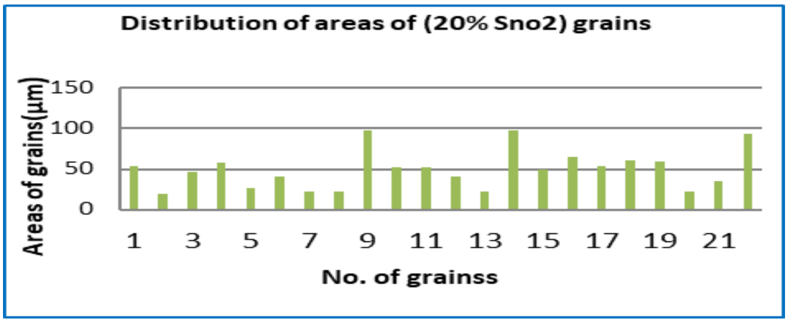
Composite thin film	Slice	Count of particles	Total Area (µm)	Mean (µm)	Median (µm)	Mode (µm)
ZnO(40%)	1µm	41	16711	407.6	342	342
SnO_2(60%	1µm	82	48541	584.6	216	414

Table (4): The data of isolate grains of ZnO(40%) :SnO2(60%) in (nm)

Composite thin film	Slice	Count of grains	Total Area (nm)	Mean (nm)	Median (nm)	Mode (nm)
ZnO(40%)	**200nm**	37	17682	477.9	294	**70**
SnO_2(60%	**200nm**	69	53251	771.8	546	**520**



(a)



(b)

Figure 8. Represents the distribution of areas grains (µm) of : a) Zno(80%) and b) SnO2(20%).

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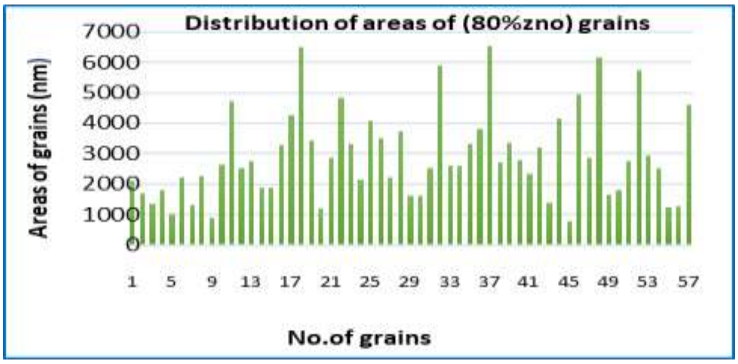
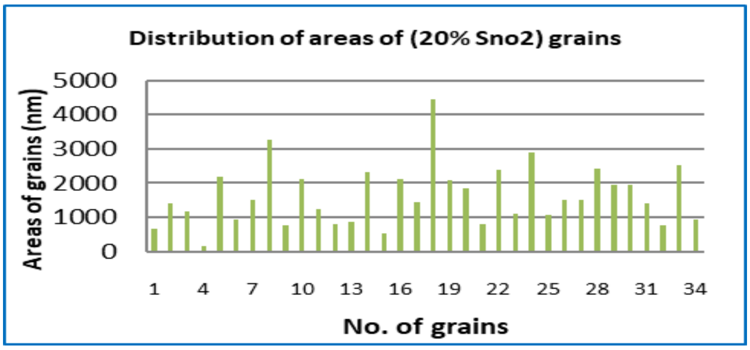
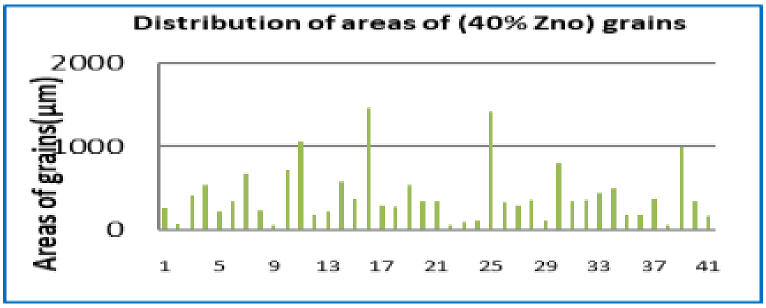


(a)

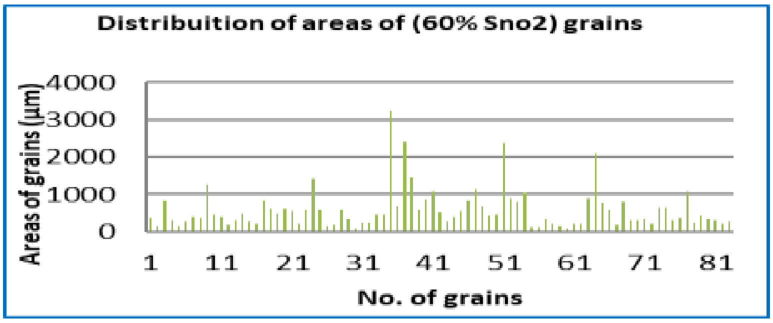


(b)

Figure 9. Represents the distribution of areas particles (nm) of: a) Zno(80%) and b) SnO2(20%).



(a)



(b)

Figure 10. Represents the distribution of areas particles (µm) of: a) Zno(40%) and b) SnO_2**(**60%)

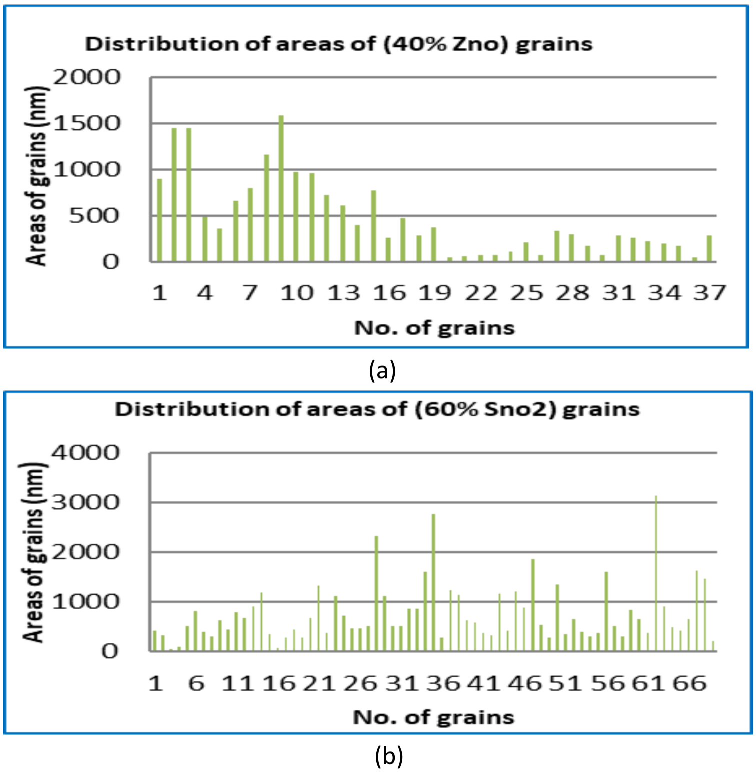


Figure 11. Represents the distribution of areas particles (nm) of : a) Zno(40%) and b)SnO2(60%)

2 Calculation the diameter ranges of grains

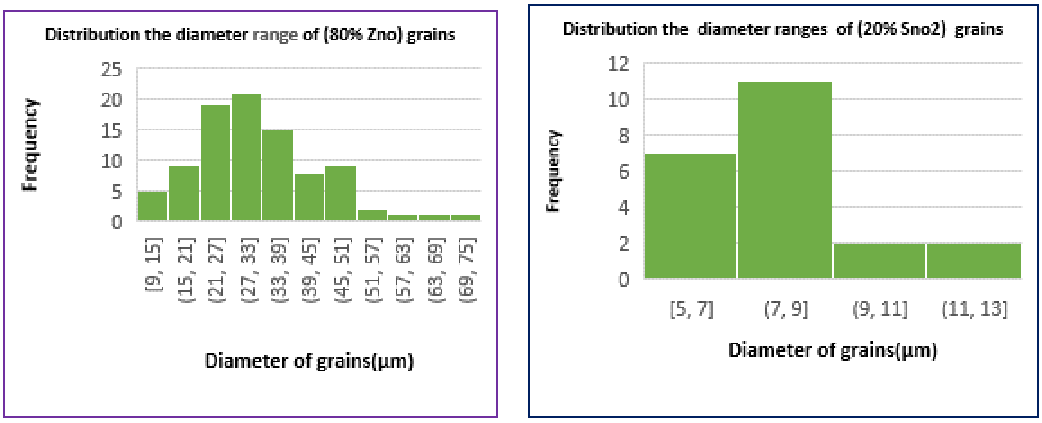
After we calculate the distribution of the granular areas as a semicircular in computation of each compound on the surface according to the specified proportions obtained the images and processed it formally and isolated the areas of the grains for each of the two compounds by the equation:

A=Л r^2 ………………..(1)

$D=2r$ …………………..(2)

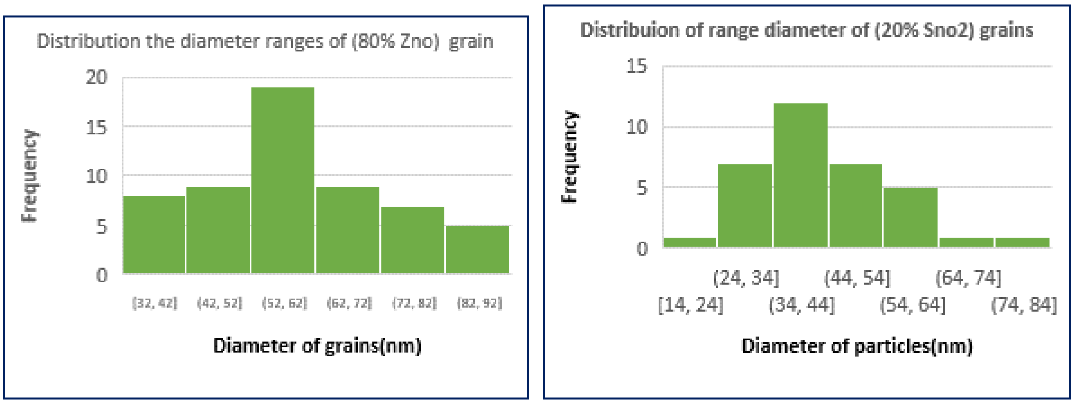
where A is the semi-circle of grains, r is the radius, and D is the diameter of particle.

we will now calculate the distribution of dimensions for each particle and the following graphics show the distribution of the diameter (µm and nm) with the frequency and shown in the following figures (8-15).



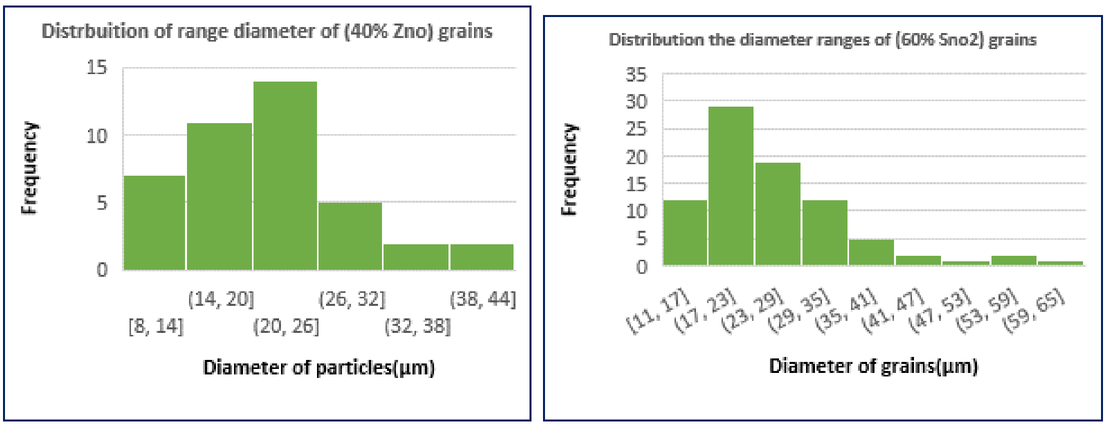
(a) (b)

Figure 12. Represents the distribution of diameter range(µm) for a) Zno(80%) and b)SnO2(20%) grains.



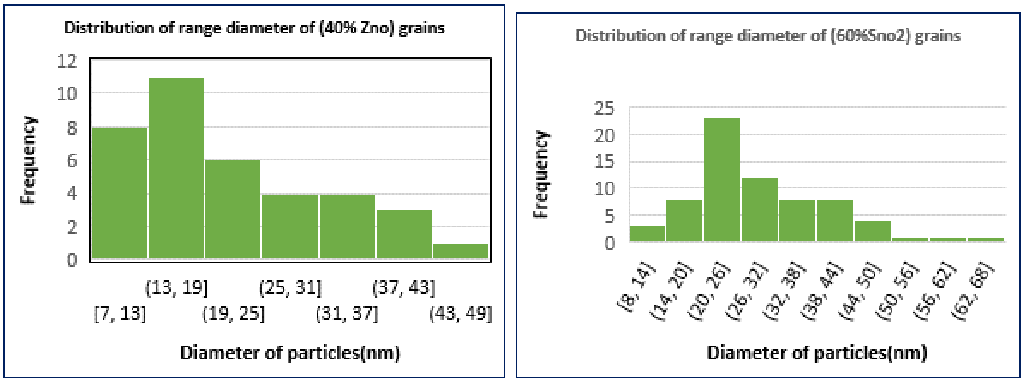
(a) (b)

Figure 13. Represents the distribution of diameter range (nm) for : a) Zno(80%) and b) SnO2(20%) grains.



(a) (b)

Figure 14. Represents the distribution of diameter ranges (µm) for: a) Zno(40%) and b) SnO2(60%) grains.



(a) (b)

Figure 15. Represents the distribution of diameter ranges(nm) for: a) Zno(40%) and b)SnO2(60%) grains.

5. Discussion and conclusions

Through the studying of the particles distribution for ZnO: SnO_2 composite thin film in SEM images with sizes in nanometer and micron meter. Image analysis enables us to determine the particles of composite and isolated the elements of the composite to two types of particles(ZnO and $SnO_{2)}$ by coloring every type as shown in figures (6,7). The results were found in clear the numbers and measurements the area for every particle and it diameter and calculated mean, median, and mode for all particle grains in the composite by nanometer and micron meter as shown in tables (1-4). We conclude that the numbers and grains in the Nano diameter are larger than the numbers of grains in the micro diameter but the areas and volumes in the micro grains have larger sizes, as well as the distribution of the Nano range diameter greater than the distribution of the micro range diameter as shown in figures (8-15).

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