ISSN: 1343-4292
Volume 140, Issue 05, August, 2022

Study the Impact of Radiation on the Synthetic Properties of SnO_2/Si reagents

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ABSTRACT— This study irradiated the tin oxide membrane deposited on glass floors at a temperature of 450 ° C. The tin was deposited in a vacuum thermal fumigation method. This makes the membrane more homogeneous than the rest of the methods. The results of X-ray analysis showed that the membrane is multi-crystallized and has access to a crystalline system by Miller coefficients. The pure unirradiated sample was found to be the predominant direction. (111) for silicon and higher intensity in addition to Miller's transactions (-120), (102) and (150) and strictly (60 a.u), (12 a.u), (490 a.u) respectively and note that there is a new angle which is 2Ɵ=25.8786 directionally (-120) After irradiation for three days there was an increase in the height of intensity at the 2Ɵ=25.8786 angles 2Ɵ=44.2498 a decrease in the intensity value at the 2Ɵ=59.1840 angle to (340 a.u). The results of the study of the AFM atomic force microscope showed that the surface before irradiation was poles and at irradiation for a full day its shape shifted from peaks to curves subject to caucasian distribution and after the radiation time increased to three days the surface was rearranged into peaks and the rate of nanoscale dimension (17 nm) was 1day irradiation time.

KEYWORDS: Thin films SnO_2/Si, Gama ray, vacuum evaporation system.

1. INTRODUCTION

Tin dioxide is a semiconductor used in the construction of electronic devices where it has a wide energy gap of direct type ranging from 3.6 ev to 4.2 ev and varies according to the deposition methods used [1].

In its volumetric state, tin oxide is one of the insulators, but it becomes a conductor if it is deposited as a thin membrane, it is a single crystal structure and has a n-type connectivity ranging from (10^{-1}- 10^4 $ohm^{-1}.cm^{-1}$) and sometimes in special circumstances it possesses a p-type connectivity [2].

Thin membranes are one of the most important branches of solid-state physics dealing with very thin systems ranging from tens of nanometers to a few micrometers [3].

Important applications in the field of thin membranes contributed to the expansion of research and study and prompted researchers to devise various ways of preparing these membranes, including through physical methods such as vacuum thermal fumigation, nutrition and chemical methods such as thermochemical degradation technique and chemical vapor deposition [4].

Kama radiation in the energy gap reacts to 3Mev essentially with the material by three processes: Compten dispersion, spouse crown and photoelectric effect. For energies below 1.022 Mev, Compten dispersion can be used and the pair can be produced [5].

The total absorbed radiation dose received by the membrane represents the dose rate multiplied by exposure

time. Increasing exposure time means increasing the amount of absorbed dose [6].

The effect of radiation on thin membranes represents the rate of linear energy transmitted (Linear Energy Transfer) Kev which corresponds expressly to the charge box and inversely to the speed box [7].

The effect of irradiation on thin membranes improves membrane behaviour as it has been found that the values of optical properties and optical properties increase by increasing the radiation dose and the value of the energy gap decreases as a result of the generation of additional energy levels within the confined area between the parity and conductivity packages [8].

Increased exposure to these potions leads to broken chemical bonds, increased interreligious distance and decreased density, resulting in crystal defects [9].

2. Materials and Methods

The SnO2/Si membrane was prepared using a vacuum thermal fumigation method using n-type silicone flooring and directional (111) square-shaped rib length (1cm). The samples were then washed in a water bath using ethanol solution for 15 minutes and dried in the oven at 100 °C.

After the cleaning process silicone samples are installed on glass floors and installed on the internal surface of the discharge device. Pure tin was used in the form of small metal balls which are placed in a sink (Boat) from the tunksten and after the pressure drop up to (10^{-5} mbar) voltages are shed on both ends of the tunksten boat and then the material heats up until the melting point reaches (1602 °C) by passing a high-intensity electric current for (10s) as a result the material evaporates and is deposited on the base of the silicon component of the thin membrane (SnO_2/Si).

Deposited samples are placed in the oven for (40 min) at a temperature (450 °C) and the oven door is opened to enter oxygen and oxidize the samples. After the oxidation process, the electrodes are deposited in a spiral pulse form with a high purity aluminum wire suspended on the spiral tunksten wire for the purpose of deposition of the poles on the membrane. After the completion of the process, the chamber is closed until the pressure reaches 2.2×10^{-4} mbar.

Front electrodes are deposited by encasing the membrane in the slovan and making a circular hole in the middle of the cover size (1mm) After the deposition of the electrodes, the membrane is ready to perform the tests on the attic and study its electrical and synthetic properties. The XRD was examined for the M1 membrane and its synthetic and electrical properties of one of the pure membranes were studied before irradiation and the rest of the membranes were irradiated with radiation dose. (14 Gy), the M2 membrane was irradiated for three hours with a radiation dose of (14Gy) by exposing it to the source (Co 60) and irradiation of the sample M3 for a full day with radiation dose (14 Gy) and irradiate the M4 sample for three days at the same dose and perform an XRD test on it and study its electrical and synthetic properties.

3. Results and Discussion

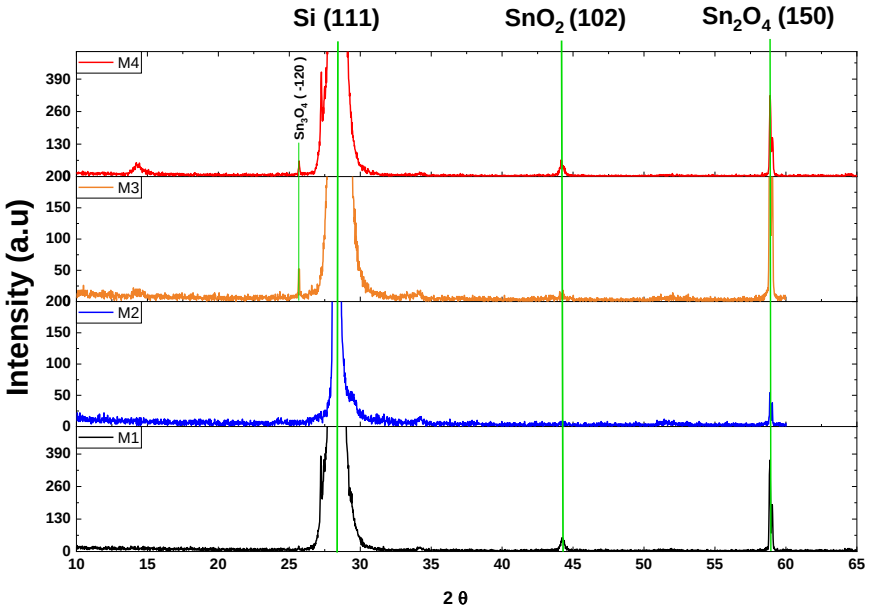
3.1 Structural characteristics of prepared membranes

3.1.1 X-ray diffraction XRD

Analysis of the results of X-ray diffraction shows that the SnO_2/Si membrane is multi-crystallized and possesses a cubic composition. Figure 1 shows a variability in the length of peaks. The tops of the M1 shape show the pure, unirradiated sample that the longest peak is (111) It is the prevailing peak in all samples plus

ISSN: 1343-4292
Volume 140, Issue 05, August, 2022

other peaks are (150) Strictly (380 a.u) and (102) severely (60 a.u) at corners 2Θ=28.5014,44.2498, 59.1840 these peaks have been consistent with the researcher [10] where the results showed a high degree of crystallization after neglecting the crystal orientation of silicon, and when increasing the irradiation duration of the whole day we note that there are several peaks in accordance with the crystal directions (-120), (102) and (150) These tops are card approved (JCPDS card no. 00-020-1293, 01-070-4177) There is an increase in the intensity of these peaks with the appearance of a directional peak (-120) severely (60 a.u) at the angle Θ=25.87862 this indicates a crystal growth that has increased the relative intensity of the peaks. After increasing the radiation duration for three days, we observe high intensity in the peaks at the 2Θ=25.8786 angles directionally (-120) at the same intensity and at the 2Θ=44.2498 angle with directions (102) severely (70 a.u) and a decrease in the intensity value to (340 a.u) at the corner 2Θ=59.1840 and the change in the intensity of some peaks is related to the impact of the irradiation duration on the crystalline structure.



Shape (1) X-ray diffraction spectrum of tin oxide membranes (SnO_2/Si)

Crystalline size of crystallized materials plays an important role in determining the properties of the material and the granular size of the Depay Sparks equation is calculated, which is an equation used to calculate the size of the nanoscale when knowing the angle of the fall and the width of the top for one of the neutralizing pattern peaks [10].

$$D = \frac{0.9\lambda}{\beta cos\theta_B} \ldots\ldots\ldots (1)$$

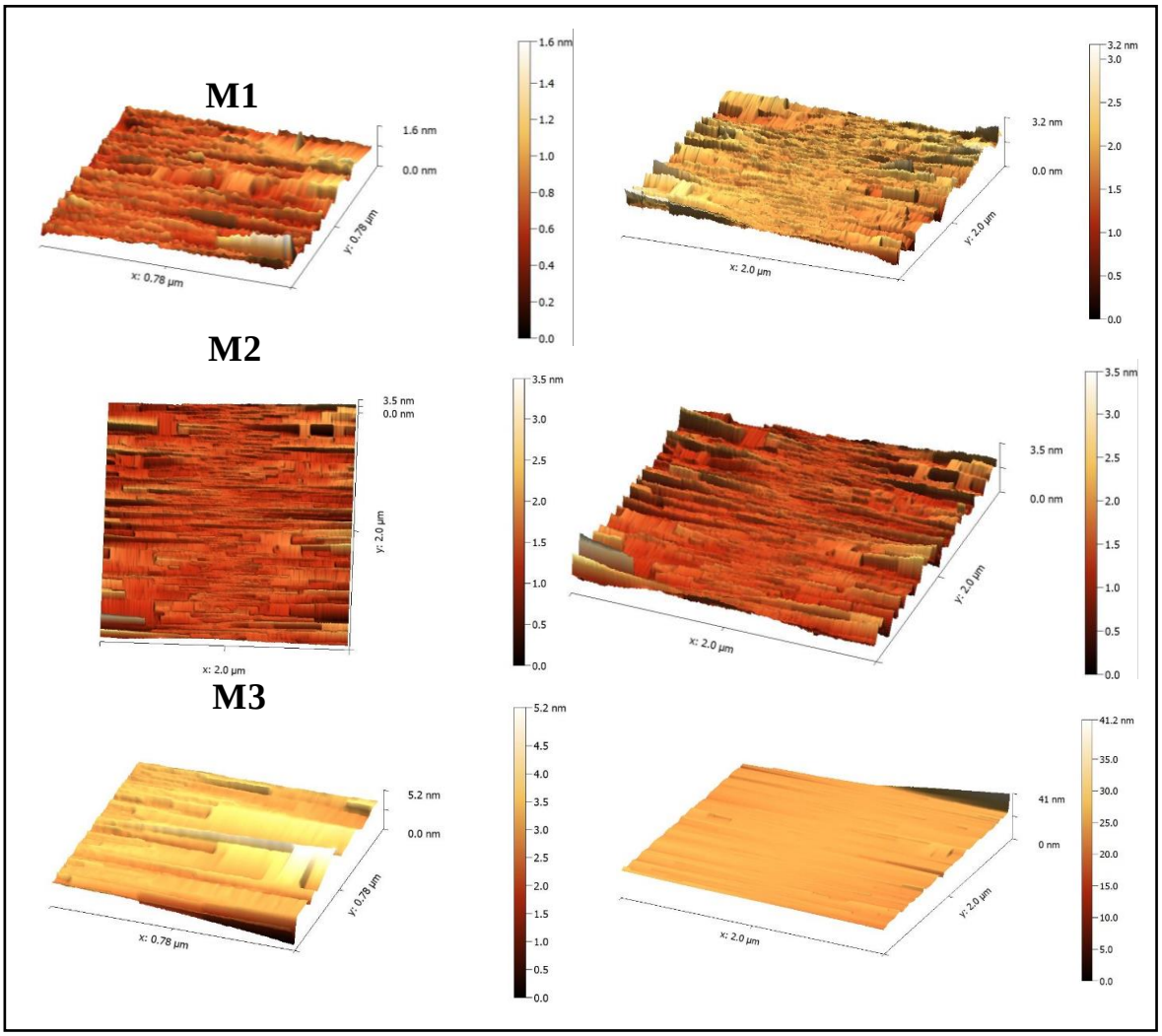
Where:
λ: Wavelength of falling X-ray
β: Peak width at mid-height (FWHM)
θ_B: BRAC Diffraction Angle

After we used the Depay sparks equation we were shown that the granular size at the angle (2Θ=28.5014) of the prevailing level (111) before irradiation is nm (46.82) and this is consistent with [10] and upon exposure to radiation for three hours the granular volume decreased to nm (42.53) At the angle

(2Ɵ=44.2498) the reason for the decrease in granular size at this angle due to the summit width at the FWHM equity, then increased to the amount of nm (161.95), either on irradiation for a full day a new angle emerged (2Ɵ=25.8786) That's when the granular volume decreased to nm (27.52) and that indicates crystal growth and then that value went up to nm. (70.78) The value of granule volume decreased to nm (42.53) because the amount of granule size is inversely proportional to the β because its increase means an increase in the width of the top resulting in a decrease in granule size and the value of granule volume increased at the corner (2Ɵ=59.1840). After the M4 sample irradiation continued for three days, the granular volume increased from nm (43.71) to nm (108.39) and this value decreased at angle (2Ɵ=25.8786). This decrease in granular volume was due to the fact that several islands were destroyed by radiation.

3.1.2 Atomic Force Microscope Results

Atomic force microscope results of models laid on glass floors showed temperature (450 °C) and irradiated at different intervals of time and with radioactive dose (14Gy) note that the square root rate and surface roughness of the pure unirradiated sample (33.15 nm) On irradiation for a full day the value of the square root rate decreased to (8.180 nm) After the irradiation period increased to three days, the square root rate increased to (68.87 nm) Thus the shape was rearranged from peaks at the time to curve Kaus, when irradiated for a full day, then rearranged to peaks at irradiation for three days, i.e., became a crystal recurrence of the surface.

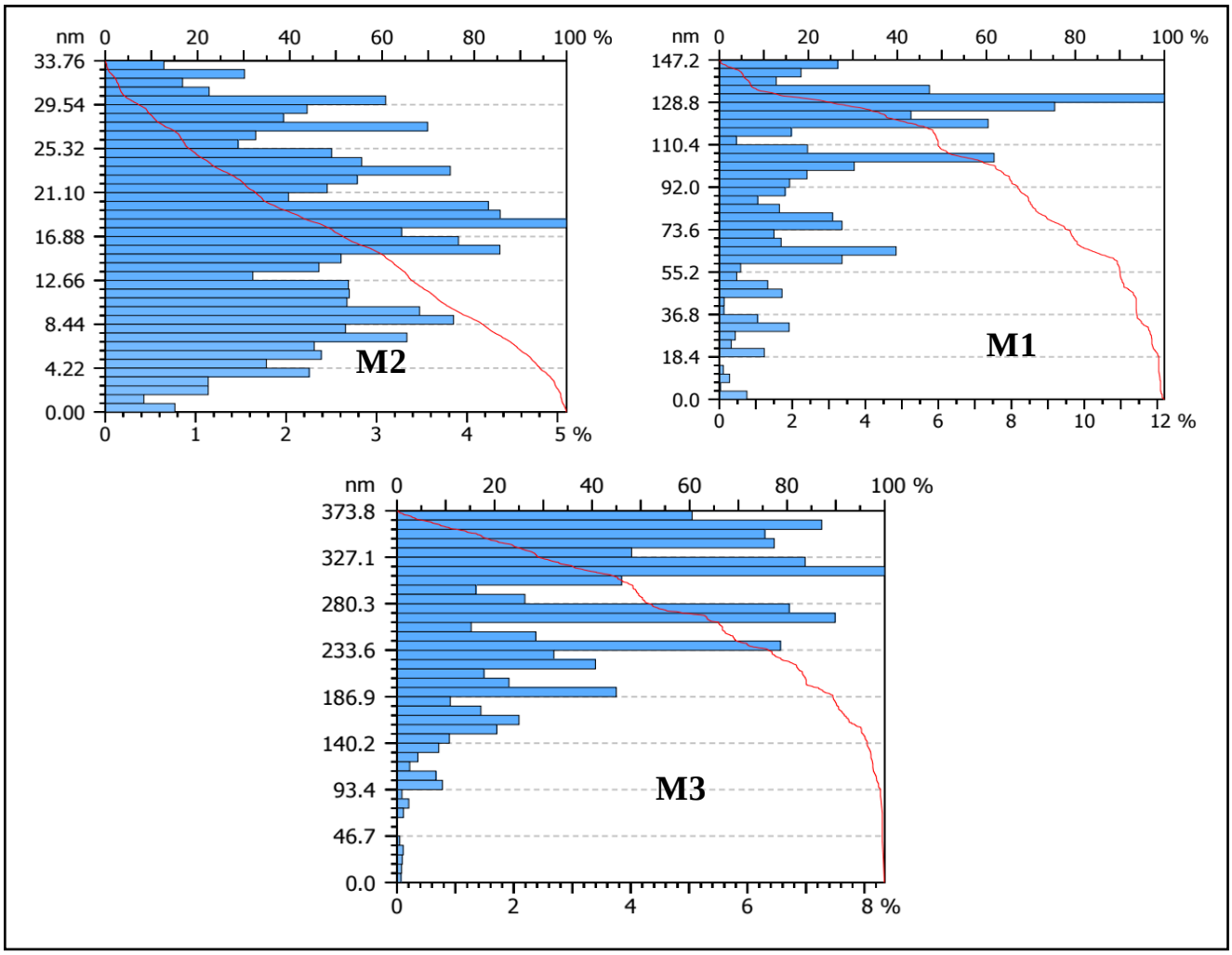


Form (2) Inspection (AFM) for M1 samples: before irradiation, M2: irradiated for full day, M3: irradiated

ISSN: 1343-4292
Volume 140, Issue 05, August, 2022

for three days

The results showed that the rate of nanoscale dimension in the pure unirradiated sample was (128.8 nm) As in figure M1 (3) and when the sample irradiated for a full day the nanoscale dimension rate decreased to (17 nm) As in figure M2 (3) this indicates an improvement in the composition of the membrane previously explained by the results (XRD) At irradiation for three days the granular volume rate increased to (300 nm) as in figure M3 (3). These results indicate a change in the shape of the granules from peaks to spherical, which is subject to caucasian distribution and then the shape of the surface is rearranged and is in the form of peaks.



Form (3) Granular Accumulation Distribution Scheme

Table (1) Relationship between irradiation time, membrane roughness and granular size

Time	RMS Roughens	Average grain
Pure	33.15 nm	128.8 nm
1d	8.18 nm	17 nm
3d	68.87 nm	300 nm

4. Conclusion

After the study of the oxidation of the tin on the glass floors in order to manufacture and irradiate a detector (SnO2/Si) and conduct a synthetic study of it, the following conclusions can be reached:

1- Irradiation for a whole day was better than irradiation for three days.

2- The emergence of a new angle at irradiation for a full day and when the irradiation time increases to three days the intensity of these angles and the material remains preserving its composition, that is, remains multi-crystallized.

3- By examining AFM there is a rejection in the synthesis of the membrane and the rate of nanoscale dimension (17 nm).

4- The shape of the granules changes from peaks to curves subject to distribution of kaos and then the order of the shape of the granules returns to peaks when the time of construction increases

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