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EFFECTS OF ADDING ZINC OXIDE(ZNO) ON THICK (PMMA) FILMS

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Abstract:
In this research, a group of materials were used, including poly methyl methacrylate (PMMA) as a base material with chloroform as a pure solvent (99.8%) with zinc oxide (ZnO) as an additive to the base material by (50%) The effects of addition on the X-ray diffraction spectrum were shown. (XRD) the base material to which zinc oxide (ZnO) was added through the distinctive peaks that gave the character of crystallization, while the effect on the thick film appeared in the scanning electron microscopy (SEM) in the form of some nodal structures of (nm) dimensions that were visible on the structure of the base material.

Keywords: ZnO ,PMMA, Effects of adding

1. INTRODUCTION

Zinc oxide (ZnO) has been used in diverse applications for thousands of years [1] and could reasonably be considered to be a mature engineering material [2] with annual production now approach- ing one and a half million tons [3] Nevertheless, there has been a steep rise in the number of scientific publications addressing this material in the last decade indicating significant new interest. In the present review we analyze this phenomenon, and show that it is driven by the prospect of many exciting new technological func- tionalities for (ZnO) while recent reviews describing aspects of the condensed matter physics, surface chemistry, synthesis techniques and semiconducting applications of (ZnO) are available [4,5] these have generally neglected the more practical aspects of the subject, including the extensive patent literature on (ZnO) In our opinion the latter contains a considerable amount of accumulated insight and information. Therefore, we provide a contemporary review of the literature – both scientific and patent – that is oriented towards larger scale industrial production methods and commer- cial applications of (ZnO). Discussion of intermediate products such as ZnO-bearing slags or fumes or "metallurgical grade" (ZnO) is largely excluded from the review as these non-standard materials require further processing before they become suitable for end-use.

Zinc oxide (ZnO) has been in use since at least 2000 B.C. as a constituent of medicinal ointments for the treatment of boils and carbuncles [1,6] Somewhat later, (ZnO) ore was exploited as a source of zinc for brass, a discovery usually attributed to the Romans [7] but which may have come from India a century or so earlier [8].

2. MATERIALS USED

1. Poly methyl methacrylate the polymer was used because of its such as excellent properties.
2. Zinc oxide(ZnO).
3. Chloroform a pure (99.8%).

3. MOLD MAKING

The thickness of the produced films was (1000μm) and area (4 cm^2).

4. THE METHOD OF WORK

The polymer used in the study was poly methyl methacrylate (PMMA) and chloroform with a purity of (99.8%) as a solvent for the polymer, grinding the polymer to facilitate the dissolution process into small granules by dissolving each (5gm) of the polymer In (100 ml) of chloroform in well-closed glass containers for (24) hours to complete the dissolution process add the support material to the polymer, which is zinc oxide (ZnO), in an amount by weight depending on the percentage (50%) after adding a substance support zinc oxide (ZnO) to the dissolved polymer, the mixing process takes place for (15 min), the casting method was used to prepare the models, after which the manufactured models are left for a period of time to dry completely.

Table 1: Weight and percentage of the support material ZnO

ZnO	weight (gm)	%
1	2.5	50

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5. RESULTS AND DISCUSSION

5.1 X-ray diffraction (XRD) analysis

5.1.1 X-ray diffraction analysis of the base material (PMMA).

X-ray diffraction analysis of the primer material (PMMA) manufactured in the form of thick film used in this research, where the distribution of the X-ray spectrum was used to show the phase of the polymer.

Figure (1) diffraction of the (PMMA) model, the polymer is classified as a polymer material consisting mainly of amorphous and crystalline region in different ratios. The pattern shows high intensity diffraction peaks at 29.16° and 19.12°, these are characteristic (XRD) peaks for (PMMA) [9], the intense peak at 19.12° indicates crystallization of the base material (poly methyl methacrylate), while the peak at 9.16° indicates that the polymer is amorphous in nature, these values indicate that the user is crystallized in one location and amorphous in another [10,11].

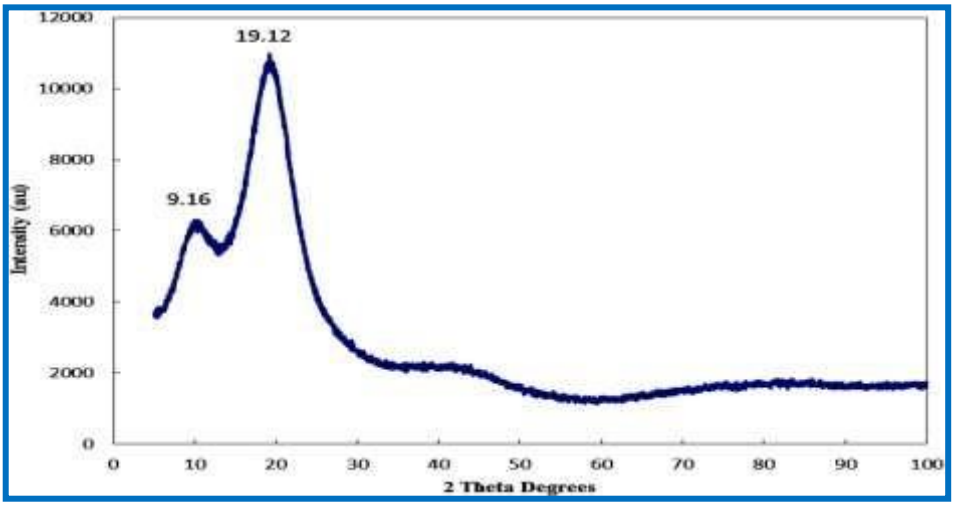

Fig. 1. Represents the X-ray spectrum of the substrate (PMMA).

5.1.2 Analysis of the X-ray examinations of the sample, the base material, with of (50%) of ZnO added.

Figure (2) represents the X-ray diffraction spectrum of the base material added to it (50%) of the zinc oxide (ZnO) material, as it was noted from the figure that the material added to the base material (PMMA) caused a change through the distinctive peaks in addition to the intensity, as the locations of the peaks appeared in the region confined between (30, 40) degrees the end of the peaks, which means the degree of crystallization, and it is an unexpected result given that zinc oxide (ZnO) is of a random nature It was observed that all peaks end with fine ends, which confirms the purity of the material used this means that the material and its content are highly crystalline in certain cases, and this is a result that is supposed to be due to the random origin of the material [12].

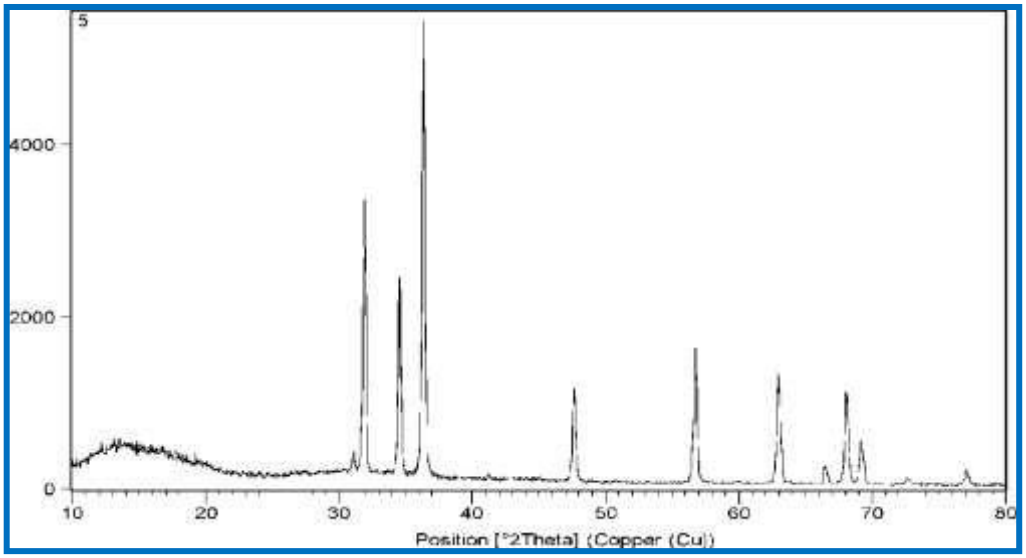

Fig. 2. Represents the X-ray spectrum of the substrate of the base material in which (50%) of ZnO is added.

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5.2 Scanning Electron Microscopy (SEM) Assay Analysis.

5.2.1 Scanning electron microscopy analysis of the base material(PMMA).

Figure (3) represents the scanning electron microscopy(SEM) examination of the unreinforced base material model with a magnification of (20 µm) It is clear from the figure that the surface composition of the base material is generally homogeneous, devoid of cavities, except for the presence of some folds on the surface, which are formed by the action of the polymer chains bundles and the mutual influence between them, while it is noted Also from the figure, , while it is noted that there are some stratified protrusions, which are produced by the re-transformation from the state of plasticity or liquidity to the solid state, which occurs in cases of glass transition, as it is noted the lamellar structure of the surface with the presence of some cavities and porous openings may be the circumstance of sclerosis [13].

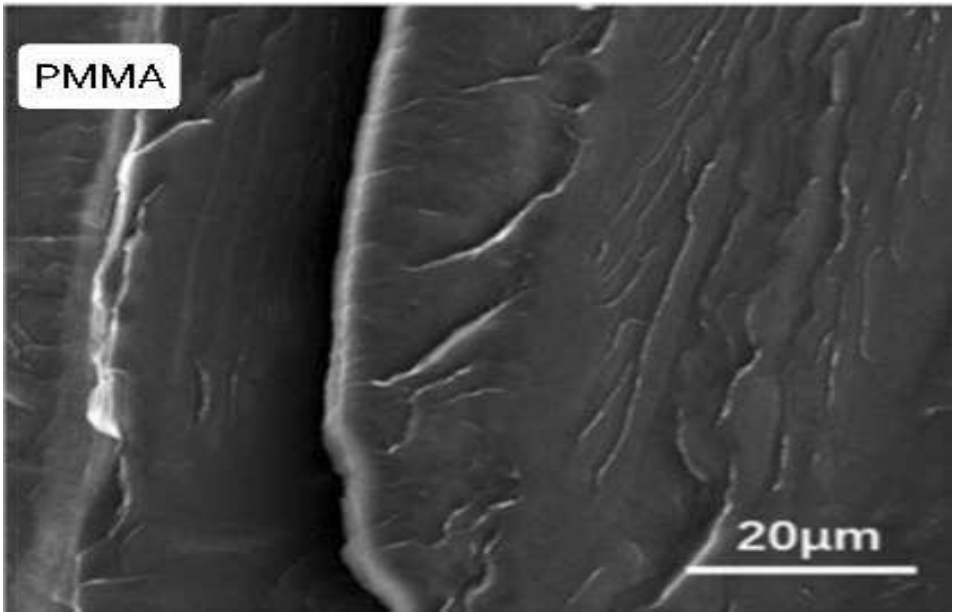

Fig. 3. SEM Image examination of the base material (PMMA).

5.2.2 Scanning electron microscopy (SEM) assay analysis of the substrate supported by (50%) ZnO added.

Image (a) of Figure (4) a scanning electron microscopy image (SEM) of the model supported by (50%) of the zinc oxide (ZnO) material and with a magnification of (200 nm) it was observed that there are structures of the scanning electron microscopy image with a size of (118.03 nm - 165.90 nm) in a more regular manner with close distances [14] .

Image (b) of the figure, the examination image with a magnification (1µm), which represents another site survey, where we notice the cumulative infrastructure in general and the metamorphoses appear in a larger size and more clear these structures were formed as a result of the surface, image (c), of the figure for examination with a magnification (2µm), the structures appear in a farther and more comprehensive location.

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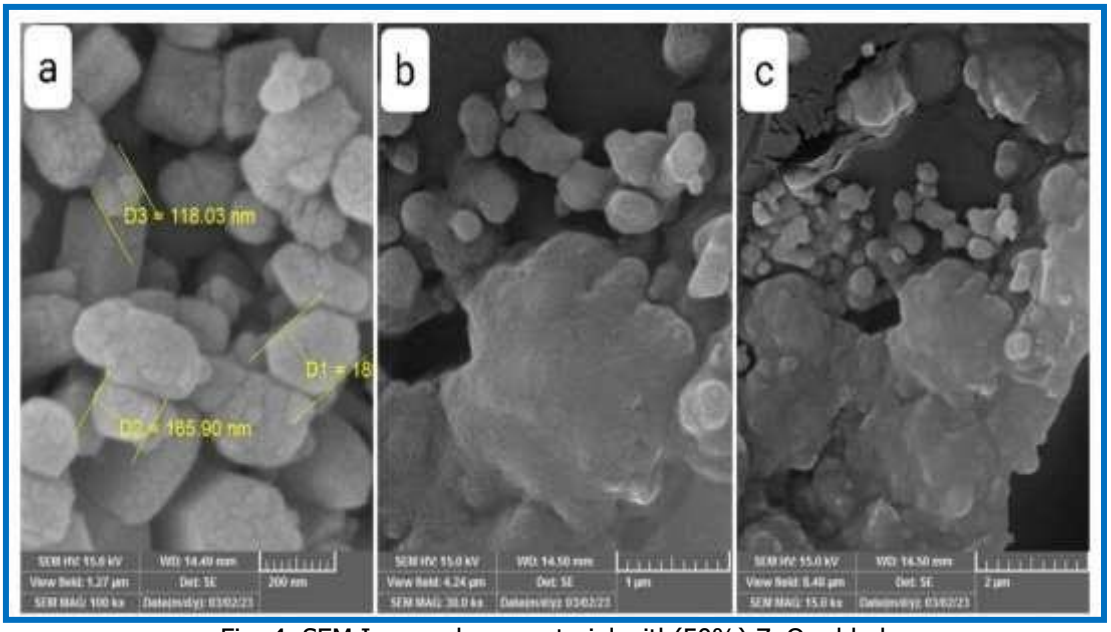

Fig. 4. SEM Images base material with(50%) ZnO added

6. CONCLUSIONS

From the results that appeared, we can conclude that zinc oxide had clear effects on the composition of pure poly methyl methacrylate (PMMA) through the appearance of the characteristic peaks of the X-ray diffraction(XRD) spectrum, in addition to the nodal structures that appeared in the scanning electron microscopy(SEM), and that zinc oxide (ZnO) can be used as a support material for the (PMMA) polymer.

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