

Preparation of ZnO-Varistors

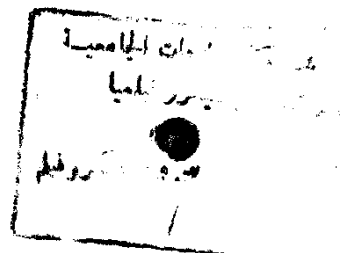
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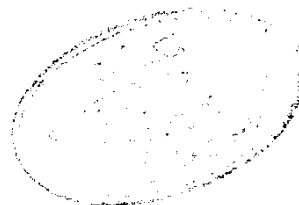
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1994

"سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْحَكِيمُ"



PREPARATION OF ZnO-VARISTORS

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Beside the work carried out in this thesis, the candidate had attended one year post graduated courses on analytical and inorganic chemistry covering the following topics:-

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- Advanced Instrumental Chemical Analysis.
- Inorganic Reaction Mechanism.
- Group Theory and Computer Application in Chemistry.
- Molecular Spectroscopy.
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CONTENTS

	page
AIM OF THE WORK	
ABSTRACT	1
I- INTRODUCTION	3
structure of ZnO	8
Effect of Additives on the characteristics of ZnO-varistors	14
Microstructure of ZnO-varistors	22
Electrical Properties	24
II-MATERIALS AND METHODS	28
2.1.1. Raw Materials	28
2.2.1. Mix Composition	28
2.2.2. Processing	28
2.3. Methods of testing	29
2.3.1. Grain size Distribution (by sedimentation)	29
2.3.2. Physical Properties	30
2.3.3. XRD Analysis	32
2.3.4. Electric Properties	32
2.3.5. Micro-structure (SEM)	35
III- RESULTS	37
3.1. starting ZnO	
3.1.1. Grain Size Distribution	
3.2.2. Physical Properties of Mixes	
3.3. Results of XRD	57
3.4. Results of Microstructure	64
3.5. Results of Electric properties	77
IV- DISCUSSION	86
V - CONCLUSION	95
VI- SUMMARY	96
VII- REFERENCES	97
VIII- ARABIC SUMMARY	

LIST OF TABLES

No.	page
1. Composition of different Mixes mol.% and Wt%	29
2. Firing shrinkage percentage of different mixes	38
3. Bulk density of different mixes (g/cm ³)	42
4. Water absorption of different mixes	45
5. Apparent porosity of different mixes	48
6. Specific gravity of different mixes	55
7. Degree of densification samples	56
8. Electric properties of group I	79
9. Electric properties of group II	80

LIST OF FIGURES

No.	page
1. Energy bands in semiconductors	4
2. Schematic representation of energy levels in excess semiconductor such as $Zn_{1+x}O$	9
3. V-I static characteristics of ZnO varistor	11
4. Principle of connection of varistor	12
5. Shows silver paint on the samples	33
6. Shows the position of varistor sample in electric circle	34
7. Grain size distribution of ZnO used	37
8. Firing shrinkage % of group I	40
9. Firing shrinkage % of group II	41
10. Bulk density of group I	43
11. Bulk density of group II	44
12. Water absorption % of group I	46
13. Water absorption % of group II	47
14. Apparent porosity of group I	49
15. Apparent porosity of group II	50
16. Bulk density of group I at different temperatures	51
17. Bulk density of group II at different temperatures	52
18. Water absorption of group I at different temperatures	53
19. Water absorption of group II at different temperatures	54
20. XRD patterns of starting calcined oxides	58
21. XRD patterns of 1mol% ZnO+1mol% Ce ₂ O ₃	59
22. XRD patterns of group I	60
23. XRD patterns of group II	61
24. Show displacement of XRD patterns of group I	
25. Displacement of XRD patterns of group II	

26.SEM of mix M ₀ group (I), growth in preferred orientation in ZnO grain	66
27.SEM of mix M ₀ group (I), the parallel cleavage planes (inverse twin planes) in ZnO grain, indicating grain growth in preferred orientation	66
28.SEM of mix M ₂ of group (I), polished thermally etched surface, x7500. showing crystal growth of ZnO grains represented by annular epitaxial tiny exsolution of Ce rich particles lying intergranular and along the growth rings	67
29.SEM map analysis for the distribution of Ce of the above image. Ce is uniformly distributed in ZnO grain, but concentrated in the intergranular accumulations	67
30.SEM of mix M ₃ group (I) growth of ZnO, the exsolution of Ce rich granules along the growth ring, in various sizes	68
31.SEM of mix M ₃ of group (I), growth of ZnO grain in preferred orientation parallel rings. exsolution of Ce rich phase along the rings and intergranular	68
32.SEM of mix Z ₀ of group (II) ZnO-ZnO grain boundaries smooth	69
33.SEM of mix Z ₀ of group (II), preferred orientation in ZnO grain	69
34.SEM of mix Z ₃ group (II), accumulation of Ce rich phase intragranular at the corners of the grains.	70
35.SEM map analysis showing Ce distribution of the above image	70
36.SEM mix Z ₃ of group (II) intragranular Ce rich phase	71
37.SEM showing line profile for Ce distribution of the above image. Ce is concentrated in the intragranular accumulation	71
38.SEM mix Z ₃ of group (II), growth of ZnO grains showed annular and Ce rich phase at the grain corners and along the growth rings	72
39.SEM map analysis for Ce of the above image. Ce concentrated in the regions of accumulation at the grain corners	72
40.SEM mix Z ₃ group (II), growth rings in a ZnO grain and exsolution of the Ce rich phase along the periphery of plates in the stock	73
41.Shows the concentration of Ce ₂ O ₃ with ZnO in ZnO grain in mix Z ₃ group (II)	74
42.EDAX shows the concentration of Ce ₂ O ₃ with ZnO and CoO in intragranular accumulation	75
43.SEM of mix M ₁ group I showing ZnO and accumulated phase of the triple point	

44.SEM of mix M1 group (I), distribution of Ce concentrated along grain boundary of the above image	76
45.Current density versus applied field for the different mixes	81
46.Current density versus applied field for the different mixes (on log paper)	82
47.Current density versus applied field for the different mixes (on semi log paper)	83
48.Resistivity versus applied field for the different mixes	84
49.mol % of Ce ₂ O ₃ versus resistivity for the different mixes (at 200 volt)	85

AIM OF THE WORK

Aim of the work

The present study comprises the following:

- 1-Preparation of ZnO-varistors by conventional method using oxides as precursors.*
- 2-Study the addition of Ce_2O_3 in the range of (2-6) mole % to ZnO standard mix containing 0.25 CoO, 0.25 Cr_2O_3 .*
- 3-Determination of physical properties (densification) and electrical properties.*
- 4- Study of microstructure developed by SEM & EDAX.*

I-INTRODUCTION

ABSTRACT

Early work on ZnO based varistor was largely limited to binary systems comprising ZnO and few mole percent of a second insulating oxide components. This leads to materials with a moderate degree of non-ohmicity, typical values for exponent of non-linearly, α -defined by $I \propto V^\alpha$, lie in the region $2 < \alpha < 6$.

The superior electric properties were developed by *Matsuoko* in multi component ZnO-varistors, where α ranged between ($30 < \alpha < 50$). A typical multicomponent varistor has a composition 97% mol ZnO, 1% Sb₂O₃, 0.5 Bi₂O₃, 0.5 CoO, 0.5 MnO₂ and 0.5 Cr₂O₃.

The field of application of ZnO varistor in low voltage was extended to high voltage electric power stations by the addition of Pr₂O₃ substituting Bi₂O₃. The merits of the addition of rare earth oxides beside extending the field of application to high voltage is directly related to the microstructure based on two phase model. As this structure increases the active grain boundary area through which electric current flows.

The effect of addition of Ce₂O₃ on microstructure, electric properties was the subject of the present study. The results achieved showed that Ce₂O₃ could be used to improve the varistor properties in the presence of their oxides as Cr₂O₃ and CoO. Low additions of Ce₂O₃ entered into solid solution with ZnO thereby rendering the material totally conductive and shows nearly ohmic relation. High addition on the other hand, showed signs non-linearity as proved from electrical properties measured. Microstructure of the product revealed the presence of two