



شبكة المعلومات الجامعية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

جامعة عين شمس

شبكة المعلومات الجامعية

@ ASUNET



شبكة المعلومات الجامعية

# جامعة عين شمس

التوثيق الالكتروني والميكرو فيلم

## قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
على هذه الأفلام قد أعدت دون أية تغيرات



## يجب أن

تحفظ هذه الأفلام بعيدا عن الغبار

في درجة حرارة من 15-25 مئوية ورطوبة نسبية من 20-40%

To be Kept away from Dust in Dry Cool place of  
15-25- c and relative humidity 20-40%



# شبكة المعلومات الجامعية التوثيق الالكتروني والميكرو فيلم

**EFFECT OF IRRADIATION ON SOME  
PROPERTIES OF LITHIUM BORATE GLASSES**

*Submitted to*

**Faculty of Science  
AIN SHAMS UNIVERSITY**

in the fulfillment of the  
Requirements for

**Master Degree in Chemistry**

*By*

**RASHA MAMDOUH HUSSEIN MOHOMED  
(B.Sc. 1994)**

**National Center for Radiation Research  
And Technology (NCRRT)**

**Atomic Energy Authority**

**1999**



## *Acknowledgment*

*The author wishes to express her great thanks to Prof. Dr. Saad Abd El-Wahab Mohammed, Faculty of Science, Ain Shams University for his capable supervision, encouragement, kind interest and guidance.*

*I would like to express my heartily and deep gratitude to Ass. Prof. Dr. Nagia Al-Alaiaty, National Center for Radiation Research and Technology for her close supervision, continuous guidance helpful discussions and valuable help in the final accomplishment this work.*

*Deepest gratitude is owed to Ass. Prof. Dr. Fathy Egg- El Din for his keen enthusiam, and valuable discussion.*

*Special thanks are due to the staff working in irradiation source facilitate in Al- Azhar University for their cooperation and assistance throughout this work.*

*Thanks are indebted to Dr. M. Abdel ElHakma, national center for research, Ass. Prof. Dr. Lobna Abdel Wahab and Ass. Prof. Dr. Ahmed Ashour, (NCRRT) for the facilities and measurements presented throughout this work.*

*My best thanks to the chairman of the National Center for Radiation Research and Technology (NCRRT).*

*Deepest Gratitude to Prof. Dr. Abdel Wahab El- Naggar, Head of Radiation Chemistry Department, National Center for Radiation Research and Technology for useful facilities throughout this work.*

*Finally, I would like to thank the staff and fellow colleagues of Radiation Chemistry Department for their cooperation and encouragement throughout this work.*



Special Thanks to Spirit of my Father  
& many Thanks to my Family and my  
Husband.



**THESIS  
ENTITLED**

**The effect of Irradiation on Some Properties of  
Lithium Borate Glasses**

**Thesis Supervisors**

**Approved**

**Prof. Dr. S. Abd- Elwahab...**

*S. M. Abdel Wahab*

Faculty of Science, Ain Shams University

**Ass. Prof. Dr. N. A. ElAlaialy.....**

*N. A. ElAlaialy*

NCRRT, AEA.

**Head of Chemistry Department**

*[Signature]*  
**Prof. Dr. ~~Said~~ Hassan**



**CONTENTS**

	<b>Page</b>
<b>List of Figures</b>	<b>I</b>
<b>List of Tables</b>	<b>IX</b>
<b>Abstract</b>	<b>X</b>
<b><u>I. Introduction</u></b>	
I.1. Description of Vitrification.	2
I.1.1 Examples of Vitrifiable substance.	3
I.2. Hypothesis of Glass Structure.	5
I.3. Glass Formation in Oxides.	5
I.4. Borate Glasses.	8
I.4.1 Boron Oxide Anomaly.	11
I.5. The Structure of Alkali Borate Glasses.	13
I.6. Radiation Damage Processes in Glass.	14
I.7. Effect of Heavy Particles.	17
I.7.1 Classification of Neutron as Energy.	18
I.7.2 Radioactive Sources.	21
I.8. Effect of irradiation (gamma and/or neutron) on glasses.	22
I.9. Structure Studies.	27
I.10. Optical Properties of Glasses.	28
I.11. Density.	30
I.12. Refractive Index.	31
I.13. Differential Thermal Analysis (DTA).	35
I.14. Crystallization Behaviour.	38
I.15. Electrical Conductivity.	40
<b><u>II- Aim &amp; Objectives</u></b>	<b>47</b>

### **III. Materials & Experimental**

III.1. Preparation of Glass Specimens.	49
III.2. Irradiation Procedure.	50
III.2.1 Gamma- Irradiation.	50
III.2.2 Neutron Irradiation.	50
III.3. Absorption Spectra Measurements.	55
III.4. Infrared Measurements.	55
III.5. Density Measurements.	56
III.6. Refractive Index	56
III.7. Differential Thermal Analysis.	57
III.8. Heat Treatment.	57
III.9. X- Ray Diffraction Measurements.	57
III.10. Electrical Conductivity Measurements.	58

### **IV. Results**

IV.1. Optical Absorption.	61
IV-2. Effect of Irradiation on the Absorption Spectrum of the Studied Glasses.	62
IV-2.1 Effect of Neutron.	62
IV- 2.2 Effect of Gamma-Irradiation.	63
IV.3. Infrared.	64
IV-3-a. The Effect of Irradiation on the Infrared Absorption Spectra	65
IV.4. Density.	108
IV.5. Refractive Index.	110
IV.6. Differential Thermal Analysis (DTA).	112
IV-7. X-rays diffraction (XRD)	129
IV.8. Electrical Conductivity.	151

### **V. Discussion**

V.1. Contribution of the Ultraviolet and Visible Absorption Spectra.	167
V.2. Infrared Spectroscopy.	174

V.3. Effect of Irradiation on Spectroscopy.	180
V.3.1 Effect of Gamma- rays.	180
V.3.2 Neutron Irradiation.	184
V.4. Density.	185
V.4.1 Effect of composition.	185
V.4.2 Effect of Irradiation.	186
V.5. Refractive Index.	187
V.5.1 Effect of Composition.	187
V.5.2 Effect of Irradiation.	188
V.6. Differential Thermal Analysis (DTA).	189
V.6.1 Effect of Composition.	190
V.6.2 Effect of Irradiation.	195
V.7. Crystallization Behaviour.	198
V.7.1 Effect of Additives.	202
V.8. Electrical Conductivity.	203
V.8.1 Effect of composition.	203
V.8.2 Effect of Irradiation.	210
 <u>Summary &amp; Conclusions</u>	 213
 <u>References</u>	 224
 <u>Arabic Summary</u>	

