

Magnetic Properties of Glass Systems (Lead Bismuthate)

B.Krishna Kumariy, Saritha Kumari, N. Sireesha

Abstract: XPS has been used to find structural information on the $x\text{PbO} \cdot (1-x)\text{Bi}_2\text{O}_3$ glass system where $x=0.23, 0.36, 0.44$ and 0.55 . The binding energies from the $\text{Pb}f_{7/2}$ and $4f_{5/2}$ core levels decrease with increasing PbO content while the full-width at half concentrated of these peaks increase. The O1s spectra show an asymmetry for samples having composition $x < 0.6$, which results from oxygen atom are the B-O-B conformations well as oxygen atom in the Bi-O-Pb and Pb-O-Pb configuration. The no of non-bridging O was establish to grow thing 82% near 93% with grow thing PbO comfortable. The documents are steady by resolves from magnetic susceptibility dimensions on the similar crystal examples. PbO bond are appropriate extra covalent in environmentally PbO and finally PbO altered its role of glass. In addition to the paramagnetic involvement in Bi^{4+} , The Susceptibility of Oxide Glasses Covers Of +ve Constant Contribution

Keywords: XPS, Magnetic Susceptibility, Sample Preparation, binding energies.

I. INTRODUCTION:

In crystal structure of PbO glasses is specially exciting flat of up and around to 80 mol% of PbO can be used to crystal web in two glasses still even if Lead oxide by themselves does not arrangement a crystal. For sample, an initial examination of the indigenous crystal construction in PbO spectacles with XPS by [1-2] found that the no of bridging oxygen reduced to growing Lead oxide satisfied such that Lead oxide acts as web changer for $\text{PbO} \leq 0.6\%$. Important reduction of glasses may include foreign readjustments of atoms are below confident situations, may central limited whole glass. a great content of full metals similar Bi_2O_3 and Lead oxide are extremely examined for the reason of their things such as physical properties, great refractive index, outstanding IR transmission and great polarizability [3-6]. Generally found by fast below conserving of fluxes, specs are metastable system in which dissimilar reduction methods decreases the identical period the learning of the glasses having slight quantities. Such as $\text{Si}_2\text{O}_3, \text{B}_2\text{O}_3$ or P_2O_5 is essential for the accepting of the system in which appropriate steady glasses might be appreciated in the nonattendance of the traditional glasses. Later the find of great temp. superconductivity [7] Bi glasses expected added concentration in interpretation of the element the glasses by suitable be originators BiO created superconductors [7-11]. examination of Bi_2 system such as Lead Oxide- Bi_2O_3 is consequently of greater attention for the understanding of the systems. The recent studies on the

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B.Krishna Kumariy, ¹Department Of Physics Malla Reddy Institute Of Technology, Maisammaguda, Dhulapally, Secundarabad-500100, Telangana, India

Saritha Kumari, ²Department Of Chemistry Malla Reddy Institute Of Technology, Maisammaguda, Dhulapally, Secundarabad-500100, Telangana, India

N. Sireesha ³Department Of Chemistry Malla Reddy Institute Of Engineering & Technology, Maisammaguda, Dhulapally, Secundarabad-500100, Telangana, India

lead silicate glass system concluded that SiO_2 is the glass former for the low concentration region. The glass former consists of SiO_4 tetrahedral and PbO_4 Is Pyramids from a Separate Network Structure. The High Concentration Region, the PbO_4 Pyramid polymeric chain reaction connect together through the SiO_4 tetrahedra to form the glass structure the local structure of binary lead vanadate glasses as a function of PbO composition has been investigated by a variety of techniques It demonstrated to be an essential instrument in the reading of resident construction of oxide glasses [12] it can separate concerning joining O (BO) and non-joining O (NBO) [13, 14] and uniform decide the attentiveness in specific corrosion state of the evolution metal in the goblet [15-16]. Additionally and effectively recycled Bi glasses would be examined in the confined construction, in Si glasses enclosing Lead oxide, an XPS examination to the Pb, Bi spectacles arrangement must the advantageous illuminating of the confined construction of the Bi glasses. The Pb 4f and O 1s spectrum must be able to divide among the distorted characters the Pb&O take part in the lead crystal network structure. Similar to the B 2p spectrum arrange fore evidence around awareness in several oxidation states of the bismuth anions. Magnetic susceptibility outcomes will similarly be existing in instruction to position for self-directed quantity amounts of the changed valence conditions of bismuth to describes surroundings of the magnetic teamwork concerning the magnetic species in these spectacles. The belongings of spectacles frequently resolute by the grade in resident instruction, investigation generous info the local structure irrelevant in instruction to recognize Since EPR has been used readings of glasses [18], important evidence of the considerate the association between local order and large objects of the essentially disorderly supplies gained [18-24]. Paramagnetic middles, it can be examined by EPR, or either one ion conversion metals to the unusual earth ions or middles related to the stimulating are disinterested imperfections the association among property & construction. EPR is the effective methods for the classification restricted instruction of magnetic connections non-crystalline arrangements in universal in specific [17]. The readings spastically balance in connected, magnetic performance of testers [25] the paramagnetic ions $\text{Fe}^{3+}(4d^5, 6S^5=3)$, $\text{Mn}^{2+}(4d^5, 6S^5=3)$ and $\text{Gd}^{3+}(5f^7, 8S^7=4)$, all are in the S state. The temp. Requirement in the equal magnetic susceptibility was examined the illustrate the magnetic conducted samples.

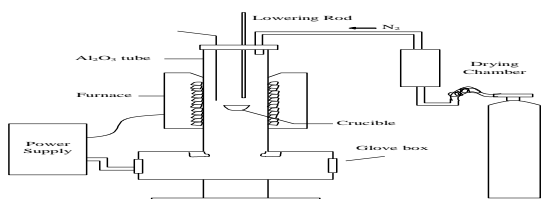
II. EXPERIMENTAL

2.1 Glass Preparation:

PbO-Bi₂O₃-Mg₂O₃ glass system,

- F₀: 40 PbO 20 Bi₂O₃ 40 Mg₂O₃---- Pure Glass
- F₁: 40 PbO 20 Bi₂O₃ 39.8 Mg₂O₃ 0.2 FeO -----
---Composite Glass
- F₂: 40 PbO 20 Bi₂O₃ 39.6 Mg₂O₃ 0.4 FeO -----
---Composite Glass
- F₃: 40 PbO 20 Bi₂O₃ 39.4 Mg₂O₃ 0.6 FeO -----
---Composite Glass
- F₄: 40 PbO 20 Bi₂O₃ 39.2 Mg₂O₃ 0.8 FeO -----
---Composite Glass
- F₅: 40 PbO 20 Bi₂O₃ 39 Mg₂O₃ 1.0 FeO -----
-Composite Glass

Correct amounts (all in mol %) of mixture evaluations of Bi₂O₃, PbO, Mg₂O₃ and FeO powders were methodically mixed in an agate mortar and heated in a platinum crucible in the temperature range 1000-1050°C in a temperature controlled furnace for about 2 h until a bubble free transparent liquid was formed. The resultant dissolve was then poured in a brass mould and subsequently annealed at 500°C. The amorphous state of the glasses was established. The discrepancy thermal analysis on these samples was approved out using STA 509°C, heating rate of 20°C / min in the temperature range of 50-1500 °C. The samples were then ground and optically polished. The final dimensions of the samples used for dielectric and optical studies were about 2cm x 2 cm x 0.4 cm. The density d of these glasses was determined to an accuracy of 0.002 by standard principle of Archimedes' using O-xylene as the buoyant liquid. The IR spectra of the glasses were recorded by KBr pellet method. Glass powders were mixed with anhydrous Magnesium bromide powder (200 mg) and pressed into pellets at 3000 kg cm⁻². Fig 1 and Fig 2-3. The point figure of Bi₂O₃-PbO [34] designates a melting temperature 100°C whole arrangement collection with a smallest nearby the Bi₂O₃ : 2PbO glassy point configuration. Near this glassy point, 3Bi₂O₃ : 2PbO and 4Bi₂O₃ : PbO points also happen. The concluding 2 points was selected education. In mutually shapes, the Bi satisfied outstrips the Pb contented while the Bi-O ratio is near the characteristic of Bi constructed superconductors. To research a vitreous 4Bi₂O₃ : PbO conditions conforming to the maximum Bi contented a glassy point in the Bi₂O₃-PbO second arrangement hardening propensity glassy to executes great cooling rates melt. Glassy samples of (100 - x)[4Bi₂O₃ : PbO]xMO and (100 - x)[3Bi₂O₃ : 2PbO]xMO systems, where MO ¼ Fe₂O₃, MnO or Gd₂O₃ and x ¼ 1, 5, 10 and 20 mol%, were found rapidly under cooling dissolve since 150°C to room temp. Initial constituents used to make to the examples were systematically clean mixtures (BiO)₂CO₃, PbO, Fe₂O₃, MnO and Gd₂O₃. The suitable combinations molten in sintered corundum containers an electric furnace, in air, at 150°C for 15 min. The constancy



of the glassy point is better-quality by

Fig-1 Block Diagramme Of Temperature Controlled Furnace.

accumulation conversion metal or rare earth oxides and be contingent absorption extracts. To The maximum steadying consequence on the glassy matrix was found by count of Gd₂O₃. EPR varieties were verified at room temp.

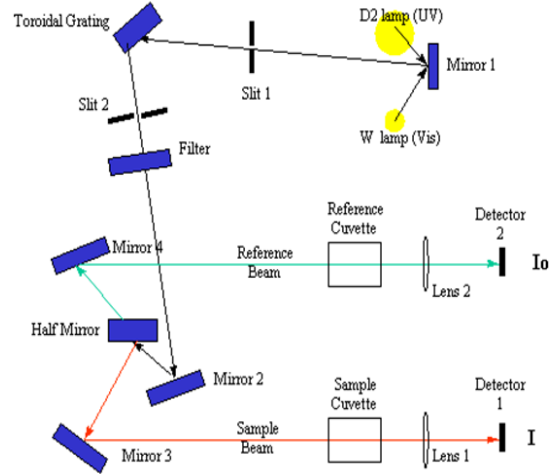


Fig-2 Block Diagramme Of The Optical Spectrophotometer

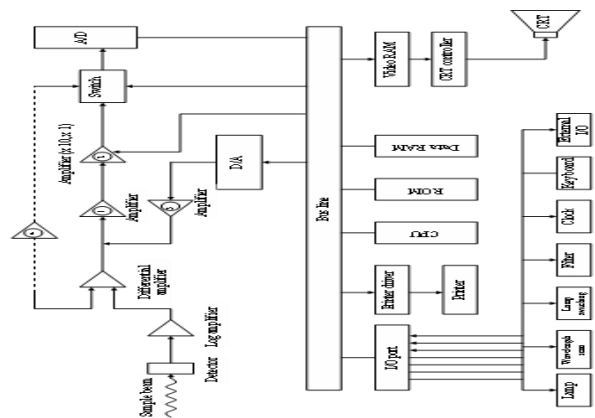


Fig-3 Block Diagramme Of The Electrical Spectrophotometer

III. RESULT AND DISCUSSION:

3.1 PHYSICAL PROPERTIES:

Our examination, prepare the sample at furnace shown in Fig. 1, and the optical and electrical observations of the XRD and SEM shown in Fig. 2, From the Calculate the reading of thickness (d) and calculated N_i and different physical parameters such as R_i and R_p of these glasses are evaluate using the conservative formulae and are presented in Table 1. And also find the sample of the thermal analysis of glass systems shown in table-2.

3.2. MAGNETIC PROPERTIES:

The temp reliant on direct magnetic susceptibility distinguished a SQUID magnetometer in a magnetic field of 6000 done a temperature series are 10–350 Kelvin. The susceptibility of the example bottle slight lower 200 Kelvins ample to create



smaller amount 3% modification maximum tempon the samples. Whole correctness of magnetic quantities valued nearly 4% outstanding the insecurity of the magnetometer calibration. shown in Table -3.

EPR spectra noted for 4Bi₂O₃ .PbO (4:1) and 3Bi₂O₃. 2PbO (3:2) conditions having Fe, Me, and Gd contain changed developments role in the absorption to the

paramagnetic ions. The EPR spectra of Fe incapacitated models conquered by line, stirring altogether glasses comprising Fe³⁺ contamination or as added One observes, principally matrix, to the growth strength line individual of the system comfortable to basic topic of opinion or with great iron satisfied and a enlargement of this line

Table-1: physical properties of 40 PbO 20 Bi₂O₃ 40 Mg₂O₃ glass system

Sample	Average Molecular Mass (M)	Thickness	Ni	Ri	Rp	Fi
F0	180.680	8.130	0	0	0	0
F1	180.685	8.228	3.60	8.36	3.99	3.8
F2	180.687	8.320	6.26	6.83	3.36	4.78
F3	180.689	8.410	8.83	4.03	3.08	5.89
F4	180.692	8.445	11.7	3.52	2.74	6.98
F5	180.694	8.510	14.5	3.20	260	7.89

Table-2: Pbo-Bi₂O₃-Mg₂O₃: FeO study the differential thermal analysis.

GI ass	Tg(K)	Tc (K)	Tm(K)	Tg/ Tm	(Tc- g)/Tg	(Tc- g)/Tm	(Tc- Tg)/(Tm- Tc)
F0	517	668	980	0.574	0.462	0.272	0.584
F1	526	697	995	0.576	0.501	0.291	0.674
F2	520	683	985	0.575	0.488	0.284	0.640
F3	515	675	973	0.574	0.486	0.283	0.637
F4	512	670	971	0.573	0.483	0.281	0.625
F5	511	663	974	0.570	0.470	0.274	0.589

Table-3: PbO-Bi₂O₃-B₂O₃ :FeO glasses of magnetic properties

S.NO	Standard (mol%)		Investigative (mol%)		x
	PbO	Bi ₂ O ₃	PbO	Bi ₂ O ₃	
1	0.30	0.60	0.35	0.76	0.35
2	0.40	0.60	0.43	0.68	0.43
3	0.50	0.50	0.55	0.59	0.55
4	0.60	0.40	0.65	0.47	0.65

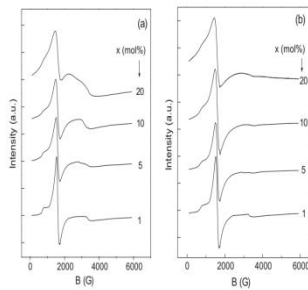


Fig-3: EPR Spectrophotometer of Glass Systems. (Lead bismuthate oxide).

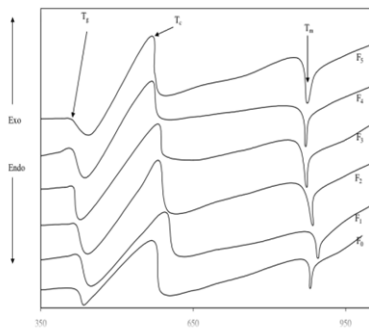


Fig-4: Differential Thermal Analysis Of Glass Systems

IV. CONCLUSION:

EPR reconsideration of spectacles appropriate arrangements $x\text{MO}(100-x)[4\text{Bi}_2\text{O}_3 \cdot \text{PbO}]$ and $x\text{MgO}(100-x)-[3\text{Bi}_2\text{O}_3 \cdot 2\text{PbO}]$ ($\text{MO} = \frac{1}{4} \text{Fe}_2\text{O}_3, \text{MgO}$ or $\text{Gd}_2\text{O}_3, x = 6, 20 \text{ mol\%}$) specifies changed surrounding ions. Notwithstanding the changes, the consequences of paramagnetic ions illustrate the Pb-Bi matrix, in the great dissatisfied district, executes to greatest of paramagnetic ions. The advanced absorptions, Fe & Mg ions incline to bunch, supporting verification to the matrix. Gd become stable of the vitreous network of the comparatively regularly dispersed to the samples propensity the sets. Such a reason that the inflexibility Pb-Bi background, district to great Bi contented, and strangely great part Gd^{3+} is positioned site the great valuable stone field low bringing together quantity. The magnetic size lead-bismuthate goblet environment demonstrate percentage among distorted valence state Fe & Mg change combination ions growth active to 40 mol%. The temp want to the magnetic susceptibility sample comprise extra 1 mol% modify metallic or rare soil oxides be in agreement to -Ve paramagnetic Curie temp delegate antiferromagnetic associations between these ions.

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AUTHORS PROFILE



I am sarithakumari, I completed my M.Phil, M.Sc from the Acharya Nagarjuna University at Guntur, present I am working in mallareddy institute of technology at Hyderabad. I completed my m.phil degree in the year of 2008 from acharya nagarjuna university, I have A grade, M.Sc degree in the year of 2004 from acharya nagarjuna university, I have 85% percentage, my M.Phil research area is material sciences, my supervisor is Nalluriveeraiahagaru he is recently retired professor in acharya nagarjuna university, I attended international and national conferences, international conferences are two, one national conference and also I have a three published international journals, one international journals one is IOSR, second one is QUEST international journal and third one is IJSER international journals. I also interested research areas are nanotechnologies, composite materials and applications of batteries. My teaching experience is 12 years, 4 years in vikasp.g college, vissannapeta, andhra Pradesh, 5 years in St.Martin's engineering college Hyderabad, telangana, remaining years Malla reddy institute of technology, Hyderabad, telangana, till date and my Ph.D research area is sodium ion batteries and its properties and also planned published the book it is processing condition. And also recently attended the faculty development Programme June 17th to 22nd 2019.



I am Krishna kumari, I completed my M.Sc from the Acharya Nagarjuna University at Guntur, present I am working in mallareddy institute of technology at Hyderabad. I completed my m.sc degree in the year of 2008 from acharya nagarjuna university, I have A grade, M.Sc degree in the year of 2004 from acharya nagarjuna university, I have 85% percentage, I attended international and national conferences, international conferences are two, one national conference and also I have a three published international journals, one international journals one is IOSR, second one is QUEST international journals and third one is IJSER international journals. I also interested research areas are nanotechnologies, composite materials and applications of batteries. My teaching experience is 6 years, 1 year in Malla Reddy engineering college (MREC) Hyderabad, telangana, remaining years Malla reddy institute of technology, Hyderabad, telangana, till date and Ph.D research area is sodium ion batteries and its properties and also planned published the book it is processing condition. And also recently attended the faculty development Programme June 17th to 22nd 2019.





I am N.Sireesha, I completed my M.Sc from the Andhra University at Nalajerla, westgodavari., present I am working in mallareddy institute of engineering and technology at Hyderabad. I completed my m.sc degree in the year of 2010 from Andhra university, I have 86% percentage I am interested research areas are hydrocyclic compounds, composite materials and

applications of batteries. My teaching experience is 8 years, 3 year in A.K.R.G engineering college at nallajerla and one year in HITS collrgr at Hyderabad and remaining years MRIET at Hyderabad telangana, till date. I am recently attended the faculty development programme from July 15th to 20th 2019.