

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 O 1s spectra show an asymmetry for samples having composition $x < 0.6$, which results from oxygen atom are the B-O-B conformation as 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 PbS 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 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].

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The read in gspa stically balanceinconnected, magneticperformance of testers [25] the paramagnetic ionsFe3p(4d5, 6S5=3), Mn2p(4d5, 6S5=3) and Gd3p(5f7,8S7=4), all are in the S state. The temp.Requirement in the equal magnetic susceptibility was examinedthe illustrate the magnetic conductedsamples.

II. EXPERIMENTAL

2.1 GlassPreparation:

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 powderweremethodically 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 bubblefreetransparentliquidwasformed. The resultant dissolve was then poured in a brass mould andsubsequentlyannealedat500°C.Theamorphous 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 glasseswasdetermined to an accuracy of 0.002 by standard principle of Archimedes' using O-xylene asthebuoyantliquid.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 tempower100⁰ Cwholearrangementcollection with a smallestnearby the Bi2O3 : 2PbO glassypointconfiguration. Near thisglassypoint, 3Bi2O3 :2PbO and 4Bi2O3 :PbO points also happen. The concluding2 points was selectededucation. 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-PbOsecondarrangementhardwingpropensity 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 foundrapidlyundercoolingdissolvessince150⁰C to room temp. Initial constituents used to make to the examples were systematically clean mixtures(BiO)2CO3, PbO, Fe2O3, MnO and Gd2O3. The suitable

combinationsmolten in sintered corundum containers an electric furnace, in air, at 150⁰C for 15 min. The constancy of the glassypoint is better-quality by

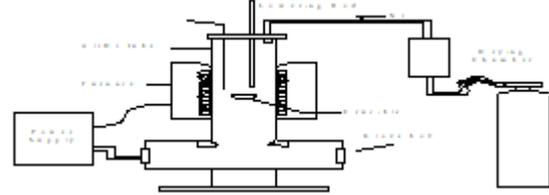


Fig-1 Block Diagramme Of Temperature Controlled Furnace.

accumulationconversion metal or rare earth oxides and be contingentabsorptionextracts. To The maximum steadying consequence on the glassy matrix was foundby count of Gd2O3.EPRvarieties were verified at room temp.

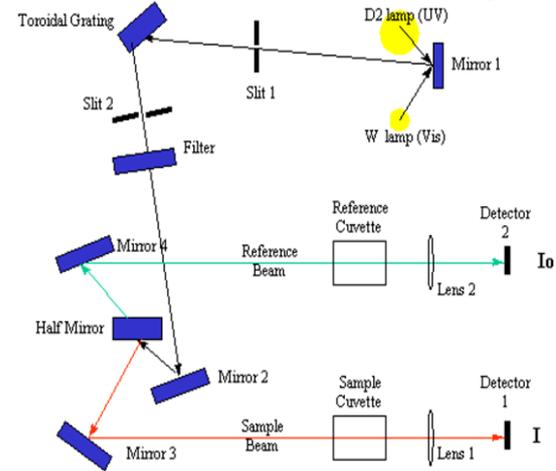


Fig-2 Block Diagramme Of The Optical Spectrophotometer

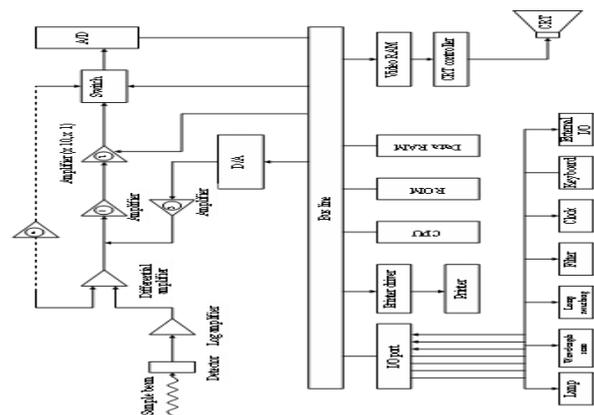


Fig-3 Block Diagramme Of The Electrical Spectrophotometer

III. RESULT AND DISCUSSION:

3.1 PHYSICAL PRROPERTIES:

Our examination, prepare the sample at furnance shown in Fig. 1, and tha 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 evaluated 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 Kelvin sample to create smaller amount 3% modification maximum temp on 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 Fe3p 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.

Gl 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	Bi2O3	PbO	Bi2O3	
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



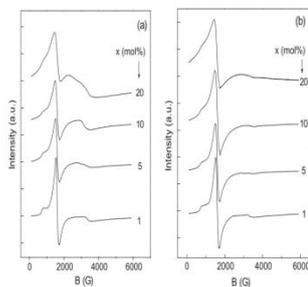


Fig-3: EPR Spectrophotometer of Glass Systems. (Lead bismuthate oxide).

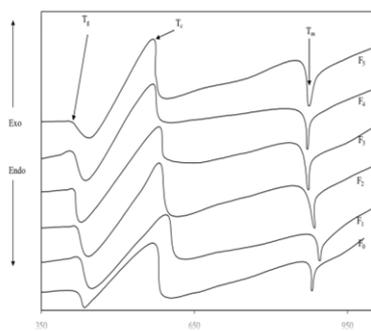


Fig-4: Differential Thermal Analysis Of Glass Systems

IV. CONCLUSION:

EPR reconsideration of spectacles appropriate arrangements $x\text{MO}(100-x)[4\text{Bi}_2\text{O}_3 \cdot \text{PbO}]$ and $x\text{MgO}(100-x) \cdot [3\text{Bi}_2\text{O}_3 \cdot 2\text{PbO}]$ ($\text{MO} = \frac{1}{4}\text{Fe}_2\text{O}_3, \text{MgO}$ or Gd_2O_3 , $x = 6, 20$ 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 the greatest of paramagnetic ions. The advanced absorptions, Fe & Mg ions incline to bunch, supporting the verification of 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 Gd³⁺ 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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