

Physical Properties of Lead Arsenate Glass System

Y. Saritha Kumari, B. Krishna Kumari, Y. David Kumar

Abstract: My Present work is lead arsenate composite material ions, study the properties of the pbo As_2O_3 glass system doped with Transition metal ions, scanning electron micro copy, EDS, X-RD and Optical absorption peaks readings wave length range is 300-1200 nm for identification of various electronic transitions metal ions. Lead Arsenate pure glasses doped with various composites of iron ions were preserved. study the samples characterized by XRD studies and SEM studies reveal the existence of $(Fe_2Pb)As_2O_6$ glassy points are also detected. The optical absorption bands of this glass have presented 3 absorption peaks on 670, 560 nm. the observed gradually growth trend the strength of the peaks due to Fe^{+2} transition ions at the expenditure of the peaks due to Fe^{+3} transition ions up to 0.6 mol% the amorphous Fe_2O_3 glasses in the range of frequency 10^2 Hz to 10^5 Hz and temperature is 77 k to 450 k.

Keywords: Glass Preparations, SEM, EDS, XRD and Optical absorption

I. INTRODUCTION

The metal ions like iron melted in pure glass matrix even in very small amounts; Affect the protecting character of these glasses very powerfully. The adding of iron to lead niobium phosphate glasses is estimated to growth the chemical stability and to fall the decomposition rate in aqueous surroundings [1]. iron have heavy-duty behavior on different material goods of glasses. A bulk sum of exciting readings are presented on the surroundings of Fe ion in various inorganic composites vice versa., SiO_2 , BO_3 , P glasses [2-11] and also tellurite glass system [12,13]. The ions are exists altered filled with holes states with altered coordination in glass conditions, for examples as Fe^{+3} transition ion polyhedron having four plane faces and polyhedron having eight plane faces and as Fe^{+2} transition ion polyhedron having eight plane faces surroundings [14, 15]. The Fe^{+2} and Fe^{+3} transition ions are well known paramagnetic ions. Fe^{+2} ion has a bulky magnetic anisotropy due to its strong spin-orbit interaction of the 3d orbital where as such anisotropy energy of Fe^{+3} transition ions is small The current investigation is at an understanding the catalytic agent act of the iron ion on the representation of $PbO-As_2O_3$ glass system by means of different analytical techniques.

1. F_0 : 40PbO-60As₂O₃ ----- Pure Glass System
2. F_1 : 40PbO-60As₂O₃: 0.2 Fe₂O₃----- Composite Glass System

3. F_2 : 40PbO-60As₂O₃: 0.4 Fe₂O₃ ----- Composite Glass System
4. F_3 : 40PbO-60As₂O₃: 0.6 Fe₂O₃ ----- Composite Glass System

II. EXPERIMENTAL STUDIES

1.1 Glass Preparation

The studies of the $PbO-As_2O_3-X Fe_2O_3$, x values are taken from 0, 0.2, 0.4 and 0.6 mol%.

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[16-18]. the materials used for the groundwork of the present glasses were analytical grade reagents pure glass of Lead Arsenate. The composites of requisite arrangements were carefully mixed in an agate mortar and heated in a platinum crucible. The heater used was a high temperature controlled heater (fig 1). The glasses were heated up to 550°C- 650°C for thirty minutes till a bubble free liquid was formed. The samples were next hardened at 300 °C in additional heater. The resulting soft was discharged on a rectangular brass mould held at room temperature. The sample ground and optically polished. The estimated final measurements of the glasses used for studying the physical assets are 1cm×1cm×0.2cm.

Revised Manuscript Received on July 05, 2019.

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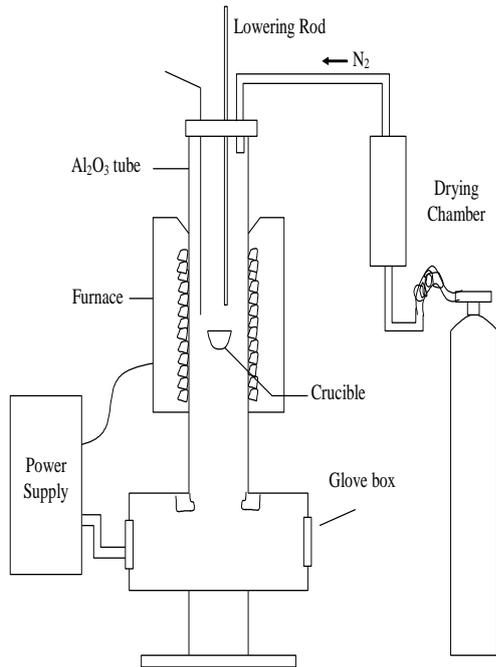


Fig – 1 Diagrammed of atmosphere-controlled furnace.

1.2 Crystallization Techniques

For crystallization the glass samples containing different collections of Fe₂O₃ heat treated in an spontaneous regulatory heater at 400°C for four hours. After the heat treatment the models were extinguished in air to room temperature.

1.3 Physical Properties

The compactness of the crystallization glass is located resolute by the normal principle of Archimedes ‘the floating liquid. A straight evaluation balance for weighting. Majority glasses are adjourned on a very tinny copper strand was set in the involvement fluid bowl and weighed in the liquid and air. Using compactness and normal molecular weight other parameters such as Fe ion collection N_i, the polar on ranger_p, etc., of the glasses are evaluated.

1.4 Optical Absorption bands

The absorption bands are lead and arsenate pure and glass ceramics be present verified using a Spectrometer wavelength is 250-1500 nanometers. The light rays entered the slitto light source (Ultra Violet) is replicated by the glass M₁ and absorbed in to the single source. The D2 is used as a source from two hundred nm to source convertingλ and W₁(VISIBLE) from source convertingλ1100nm, there are exchanged spontaneously according to the λ range. The position light source mechanically exact for supreme sensitivity and the source condenser mirror is positioned outside the source housing so as not to be exposed to heat rays and ozone. All the optical elements excluding the source are sealed from the external atmosphere by the window plate W so as to be dust free. The slit width of the monochromatic fixed at 2nm. The beam coming from the monochromatic is passed from side

to side the stray-light cut off F, reflected by glass M₂ and then split by the1/2 glass M₃ into the sample and reference beams. Each beam passes through the respective cell to photo diode detector. [fig3]. In the electrical system of the spectrometer, the main control element is a microcomputer Control Processing Unit which controls the light source lighting, and switching filter converting λ scan, presentation, control panel & copier.

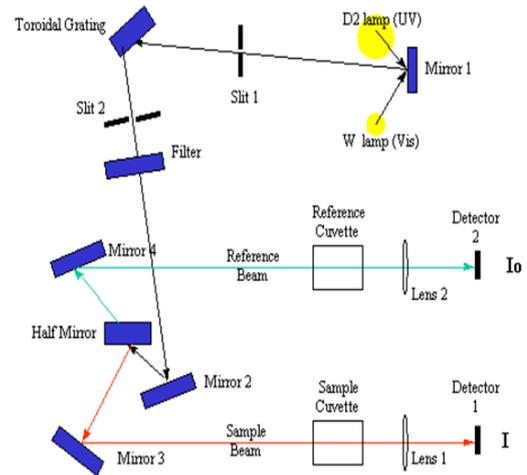


Fig – 2 optical system of the spectrophotometer

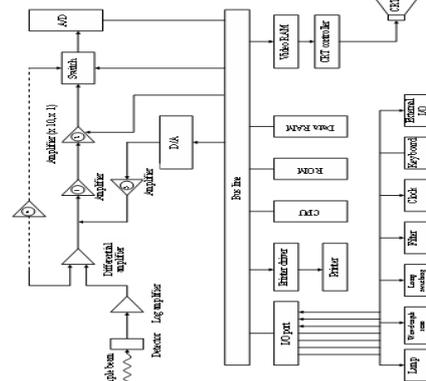


Fig. 2.3 electrical system of the spectrophotometer

III. RESULTS

1 Physical Properties

Study the standards of compactness d and deliberateM̄, several parameters such as Ni and R_i of the glass ceramics are estimated using the formulae [6].

Table -1 Pbo-As₂O₃- Fe₂O₃ glasses physical parameters.

Sl.N o.	property	glass F ₀	glass F ₁	glass F ₂	glass F ₃
1	Compactness (g/cm ³)	6.125 5	6.437 9	6.489 6	6.497
2	M̄	208.9 8	208.8 6	208.7 3	208.6 0
3	N _i (×10 ²¹ ions/c m ³)	-	4.21	7.38	8.28
4	R _i (A ⁰)	-	5.821	4.393	3.911
5	polram radius R _p (A ⁰)	-	2.75	2.17	1.15

2 XRD Analysis

The XRD of the $PbO-As_2O_3$ glasses (fig3.1) crystallized at $400^\circ C$ doped with different collections of nucleating proxyron ions designated that the composite samples involve $PbFe_4 As_5 O_{11} \cdot 2Fe_2 Pb As_2 O_6$ crystal points along with the $PbO-As_2O_3$ crystal points. The glass ceramic exist the Fe^{3+} and Fe^{2+} states.

1.5 SEM&EDS

The SEM pictures some of the crystallized samples (fig3.2). scanning electron microscope pictures of the crystallized samples display well-known and unsystematically dispersed crystal ingrained in smooth matrix. The compound powder and paint of the samples in shown in(fig3.3). The Energy Dispersive Spectroscopy examination of the composite materials displays lead, Arsenat and Fe elements in various crystal-like phases. (Fig 3.4). X-Ray charts specify the practically equal arrangement of Fe ions in the entire composite materials

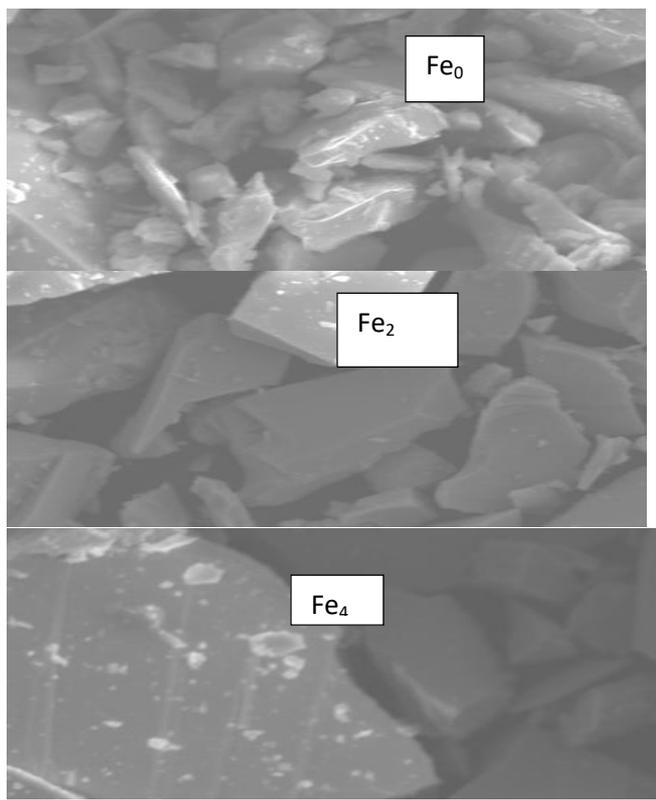
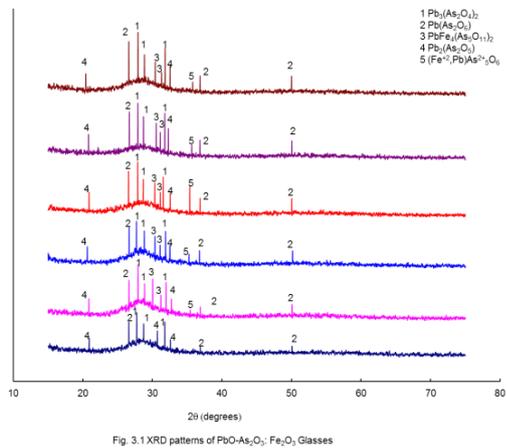


Fig – 3.2 SEM photographs of $PbO-As_2O_3: Fe_2O_3$

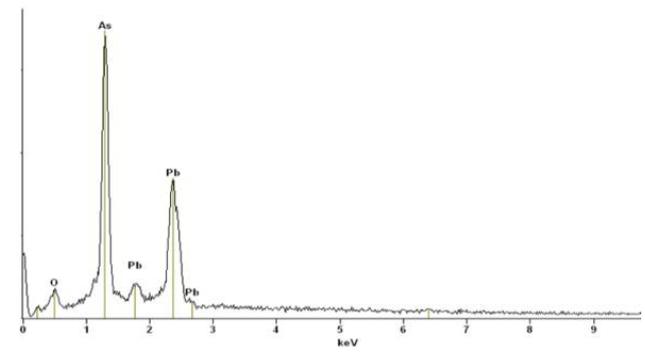


Fig.3.3 (a) EDS glass ceramic sample F_0

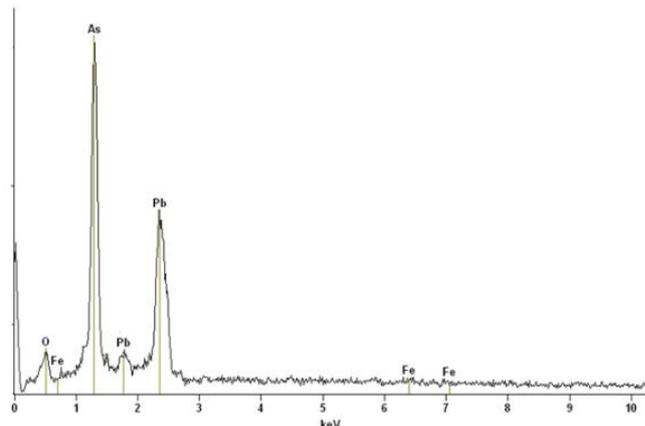


Fig.3.3 (b) EDS glass ceramic sample F_2

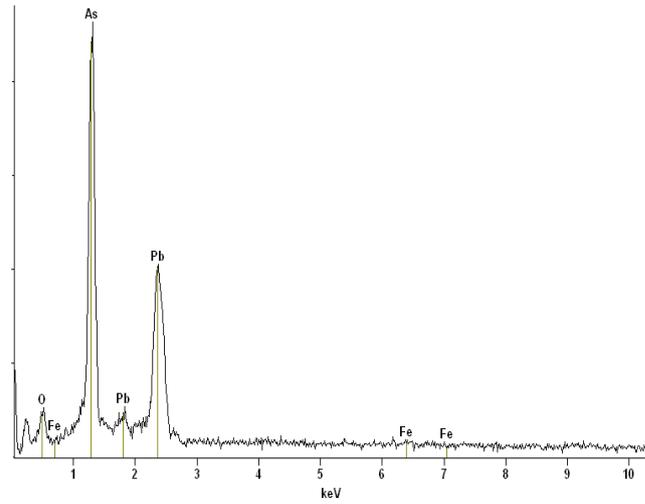


Fig.3.3 (c) EDS glass ceramic sample F_4



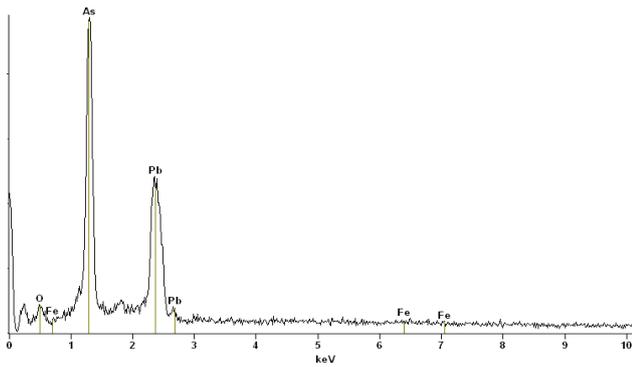


Fig.3.3 (d) EDS glass ceramic sample F₅

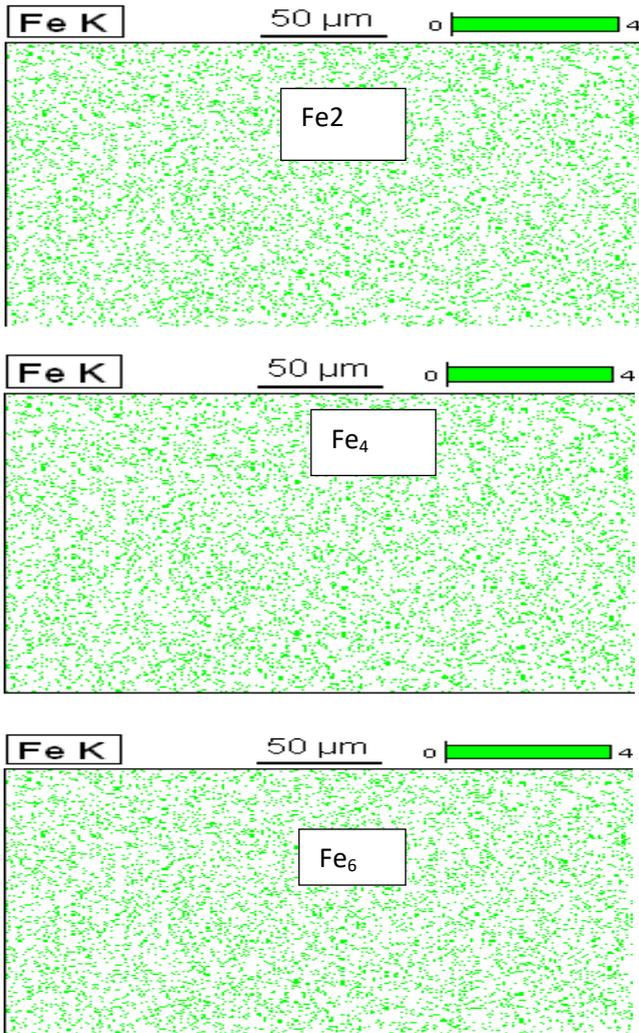


Fig. 3.4 PbO-As₂O₃:Fe₂O₃X-Ray mappings

3.4 Optical Absorption bands

The absorption peaks (fig 3.5) all the PbO-As₂O₃: Fe₂O₃ glass ceramics verified at room temperature has displayed three absorption peaks at about 670, 560 nanometer; this peaks are recognized in line for to Fe³⁺ transition ions. Moreover a peak at 900nm, recognized due to Fe²⁺ [19] is also sited in the spectra. With growth in the doped Fe collection of up to 0.6 moll percentage the strength of peaks due to Fe²⁺ transition is perceived to growth; when the attentiveness of Fe₂O₃ is raised elsewhere 0.3 moll percentage a continuing reduction in the strength of

the peaks due to Fe²⁺ transition could visibly be detected while that of band due to Fe³⁺ transition is observed to increase.

Table-2 PbO-As₂O₃ glass ceramics optical absorption peaks

Sl.No	Fe ³⁺ transitions (nm)		Fe ²⁺ transition (nm)
	${}^6A_1(t^3_2g e^2_g) \rightarrow a^4T_2(t^4_2g e_g)$	${}^6A_1(e^2 t^3_2) \rightarrow a^4T_1(e^3 t^2_2)$	${}^5T_{2g} \rightarrow {}^5E_g$
1	560	670	900
2	560	670	900
3	560	670	900
4	560	670	900
5	560	670	900
6	560	670	900

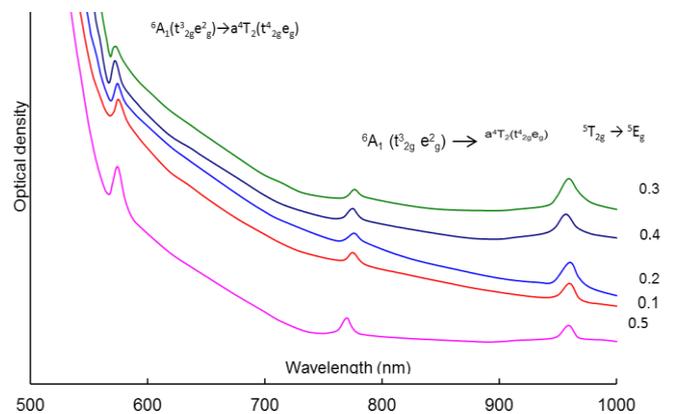


Fig.3.5 Optical absorption peaks of PbO-As₂O₃: Fe₂O₃ glass ceramic samples.

IV. CONCLUSION

The main study of physical properties of crystallized (40-X) PbO-60As₂O₃: X Fe₂O₃ glass are summarized below.

1. The developing of take shape Fe₂O₃ causes a minor increase in the compactness of PbO-As₂O₃: X Fe₂O₃ glasses; the suggestive of increasing structural compression of the material.
2. The XRD of the crystallized lead arsenate pure glasses doped with different collections of nucleating proxyiron ions designated that the composite samples involve PbFe₄ (As₅O₁₁)₂, Fe₂PbAs₂O₆ crystal points along with the PbO-As₂O₃ crystal points. The glass ceramics exist the Fe³⁺ and Fe²⁺ states.
3. The SEM pictures the crystallized samples PbO-As₂O₃: Fe₂O₃ glasses display well known and unsystematically dispersed crystals ingrained in smooth matrix.
4. Energy Dispersive Spectroscopy examination of the pure & composite materials displays lead, Arsenat and Fe elements in different crystalline phases. X-Ray maps indicate therealistically equal arrangement of Fe ions in the entire composite materials.
5. The optical absorption peaks of all the PbO-As₂O₃: Fe₂O₃ glass composites verified at

room temperature has displayed three absorption peaks at about 670, 560 nanometers; the peaks are recognized due to Fe^{3+} ions. Moreover a peak 900nm, recognized due to Fe^{2+} ions is also sited in the peaks. With growth in the doped Fe collection of up to 0.6 mol% the strength of peaks due to Fe^{2+} transition are perceived to grow; when the collection of Fe_2O_3 is higher elsewhere 0.3 mol percentage a continuing reduction in the strength of the peaks due to reason the Fe^{2+} transition could obviously be perceived while that of band due to Fe^{3+} transition is observed to grow.

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AUTHORS PROFILE



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