Structure and properties of CaF2-B2O3 glasses

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Source: JOURNAL OF MATERIALS SCIENCE Volume: 47 Issue: 9
Pages: 4028-4035 DOI: 10.1007/s10853-012-6256-y Published: MAY 2012

Abstract

FTIR spectroscopy has been employed to investigate the structure of CaF2-B2O3 glasses. It is proposed that CaF2 partially modifies the borate network forming Ca-1/2(2+)[BO3/2F](-) units. The rest of CaF2 is assumed to build an amorphous network formed of CaF4 tetrahedra. Analysis of density and molar volume revealed that the volume of CaF4 tetrahedron in the studied glasses is slightly greater than that in the crystalline form. Data of density, molar volume, and electric conductivity have been correlated with the glass structure. As far as the authors know, CaF2-B2O3 glasses are investigated for the first time.

Accession Number: WOS:000302241900011

Document Type: Article

Language: English

KeyWords Plus: SODIUM-BORATE GLASSES; LEAD FLUOROBORATE GLASSES; NAF-NA2O-B2O3 GLASSES; SYSTEM; FLUORIDE; SPECTRA; DENSITY; SPECTROSCOPY; RESONANCE; TRANSPORT

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Publisher: SPRINGER, 233 SPRING ST, NEW YORK, NY 10013 USA

Web of Science Categories: Materials Science, Multidisciplinary

Research Areas: Materials Science

IDS Number: 918IF

ISSN: 0022-2461

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Author(s): Doweidar, H; El Damrawi, GM; El-Maksoud, SA
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Author(s): KAMITSOS, EI; KARAKASSIDES, MA; CHRYSSIKOS, GD
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Structural role of MgO and PbO in MgO-PbO-B2O3 glasses as revealed by FTIR; a new approach

Author(s): Doweidar, H (Doweidar, H.)[1] ; El-Damrawi, G (El-Damrawi, G.)[1] ; Mansour, E (Mansour, E.)[2] ; Fetouh, RE (Fetouh, R. E.)[1]
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Source: JOURNAL OF NON-CRYSTALLINE SOLIDS Volume: 358 Issue: 5 Pages: 941-946 DOI: 10.1016/j.jnoncrysol.2012.01.004 Published: MAR 1 2012

Abstract

FTIR spectra of three MgO-PbO-B2O3 glass series have been analyzed. There is a decrease in the fraction N-4 of four coordinated boron with increasing the MgO content, at the expense of PbO. A new technique has been presented to make use of the N-4 data and follow the change in the modifier and former fractions of PbO and MgO. These fractions change markedly, at different rates, with the glass composition. The fraction of modifier MgO is always less than the MgO content, which suggests a former role of this oxide in the studied glasses. The ability of the glass to include MgO increases with increasing PbO content. (C) 2012 Elsevier B.V. All rights reserved.

Author Keywords: PbO-B2O3 glasses; MgO-B2O3 glasses; MgO-PbO-B2O3 glasses; FTIR analysis; Infrared spectra

KeyWords Plus: LEAD BORATE GLASSES; NUCLEAR MAGNETIC-RESONANCE; CATION-SITE INTERACTIONS; VIBRATIONAL-SPECTRA; PHOSPHATE-GLASSES; SILICATE-GLASSES; BORON-OXIDE; DENSITY; SYSTEM; MGO-AL2O3-B2O3

Reprint Address: Doweidar, H (reprint author) Mansoura Univ, Fac Sci, Glass Res Grp, Dept Phys, Mansoura 35516, Egypt.

Publisher: ELSEVIER SCIENCE BV, PO BOX 211, 1000 AE AMSTERDAM, NETHERLANDS

Web of Science Categories: Materials Science, Ceramics; Materials Science, Multidisciplinary

Research Areas: Materials Science

IDS Number: 924BE

ISSN: 0022-3093

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Author(s): Metwalli, E
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Author(s): MOUSTAFA, YM; DOWEIDAR, H; ELDAMRAWI, G
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Author(s): NELSON, BN; EXARHOS, GJ
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Author(s): Takaishi, T; Jin, JS; Uchino, T; et al.
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Structure-properties changes in ZnO-PbO-GeO2 glasses

Author(s): Mansour, E (Mansour, E.)[1] ; El-Damrawi, G (El-Damrawi, G.)[2] ; Fetoh, RE (Fetoh, R. E.)[2] ; Doweidar, H (Doweidar, H.)[2]
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Source: EUROPEAN PHYSICAL JOURNAL B Volume: 83 Issue: 2
Pages: 133-141 DOI: 10.1140/epjb/e2011-20211-2 Published: SEP 2011

Abstract

We have studied the structure of ZnO-PbO-GeO2 glasses by Fourier transform infrared spectroscopy and showed that the analysis of the vibrational spectra can lead to a quantitative description of the network structure in terms of the fraction of the local germanate polyhedra. The presence of GeO4, GeO6 and GeO4 with NBOs units was evidenced in the studied glass network. The initial additions of ZnO would introduce modifier Zn2+ ions at the expense of the former PbO4 units. With increasing ZnO content, ZnO4 tetrahedra would mainly replace modifier PbO. The decrease in density when introducing ZnO at the expense of PbO content is not only due to the vast difference in molecular mass between PbO and ZnO, but also due to the formation of Q(2) and Q(3) units. The glass network of the investigated glasses posseses a more covalent character upon replacing ZnO for PbO. This is the reason for increasing the microhardness and the glass transformation temperature of the glasses investigated with increasing zinc oxide content. The change in the conductivity at certain temperature not only attributed to the change in the covalency of the glass matrix upon replacing PbO by ZnO but also due to a change in the strain energy because of the change in V-m .

Accession Number: WOS:000296633500002

Document Type: Article

Language: English

KeyWords Plus: BISMUTH-GERMANATE GLASSES; LITHIUM BORATE GLASSES; VIBRATIONAL SPECTROSCOPY; PHYSICAL-PROPERTIES; PHOSPHATE-GLASSES; IR SPECTROSCOPY; RANGE ORDER; X-RAY; SYSTEM; RAMAN

Reprint Address: Mansour, E (reprint author) Beni Suef Univ, Dept Essential Sci, Ind Educ Coll, Bani Suwayf, Egypt .

Publisher: SPRINGER, 233 SPRING ST, NEW YORK, NY 10013 USA

Web of Science Categories: Physics, Condensed Matter

Research Areas: Physics

IDS Number: 842WW

ISSN: 1434-6028

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Author(s): DOWEIDAR, H; ZEID, MAA; ELDAMRAWY, GM
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Author(s): KAMITSOS, EI; PATSIS, AP; KARAKASSIDES, MA; et al .
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Author(s): KAMITSOS, EI; KARAKASSIDES, MA; CHRYSSIKOS, GD
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Author(s): KAMITSOS, EI; KARAKASSIDES, MA; CHRYSSIKOS, GD
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Author(s): Kassab, L. R. P.; Hora, W. G.; Martinelli, J. R.; et al .
Conference: 7th Brazilian Symposium on Glasses and Related Materials/3rd International Symposium on Non-Crystalline Solids in Brazil Location: Maringa, BRAZILDate: NOV 13-16, 2005
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Author(s): Kim, Y; Saienga, J; Martin, SW
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Author(s): Mansour, E.; El-Damrawi, G .
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Electrical properties and FTIR spectra of ZnO-PbO-P2O5 glasses

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Pages: 2137-2143 DOI: 10.1016/j.physb.2010.01.121 Published: APR 15 2010

Times Cited: 10 (from Web of Science)

Abstract

Glasses of chemical composition xZnO center dot(60-x)PbO center dot 40P(2)O(5) (x = 10-60 mol%) have been prepared and investigated for FTIR, density, molar volume (V-m), and DC conductivity. Both density and molar volume decreases systematically with composition. FTIR analysis indicates that >= 30 mol% (PbO and/or ZnO) enters the glass structure as formers. Below and above that concentration a decreasing amount of Pb2+ (Zn2+) is incorporated into the network as modifier. The band at 1018-1025 cm(-1) can be considered as an indication for the presence of P-O-Pb(Zn) linkages. By introducing ZnO into the glasses, P-O-Pb(Zn) linkages may be formed by opening up P=O bonds of PO4 tetrahedra. For all glasses the linear dependence of the conductivity indicates an ionic conduction due to Pb2+ and/or Zn2+ ions. The increase in activation energy by about 68%, and also the decrease in the conductivity at certain temperature not only attributed to an increase in the covalency of the glass matrix upon replacing PbO by ZnO but also due to an increase in the strain energy because of the decrease in V, of the studied glasses. It is found that the conductivity of ZnO-PbO-P2O5 glasses is four orders of magnitude higher than that of ZnO-PbO-B2O3 glasses containing the same amount of ZnO measured at the same temperature. In addition, both conductivities decrease with composition which may indicate that the origin of these decreases may be the same regardless the type of the host glass former. The differences in electronegativity and size of Zn2+ and Pb2+ divalent ions and the structural changes that will follow in the network govern the conductivity behaviour of Zn-Pb containing glasses. (C) 2010 Elsevier B.V. All rights reserved .

Accession Number: WOS:000276667400040

Document Type: Article

Language: English

Author Keywords: FTIR; Density; Electrical conductivity; Phosphate glasses

KeyWords Plus: MELTING PBO-ZNO-P2O5 GLASSES; LITHIUM BORATE GLASSES; LEVEL NUCLEAR WASTE; PHOSPHATE-GLASSES; PHYSICAL-PROPERTIES; MAS-NMR; SPECTROSCOPY; RAMAN; CRYSTALLINE; SYSTEM

Reprint Address: Mansour, E (reprint author) Beni Suef Univ, Dept Essential Sci, Ind Educ Coll, Bani Suwayf, Egypt .

Publisher: ELSEVIER SCIENCE BV, PO BOX 211, 1000 AE AMSTERDAM, NETHERLANDS

Web of Science Categories: Physics, Condensed Matter

Research Areas: Physics

IDS Number: 583IK

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Author(s): Abid, M; Et-tabirou, M; Taibi, M
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Author(s): DOWEIDAR, H; ZEID, MAA; ELDAMRAWY, GM
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Author(s): KAMITSOS, EI; KARAKASSIDES, MA; CHRYSSIKOS, GD
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Author(s): Liu, HS; Chin, TS; Yung, SW
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Conference: 6th International Workshop on Disordered Systems Location: ANDALO, ITALYDate: MAR 03-06, 1997
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Influence of gamma-irradiation on some physical properties of chlorophyll/PMMA films

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Source: APPLIED SURFACE SCIENCE Volume: 256 Issue: 9 Pages: 2711-2718
DOI: 10.1016/j.apsusc.2009.11.015 Published: FEB 15 2010

Abstract

Films of poly(methylmethacrylate) PMMA doped with different concentrations of chlorophyll, from 2.5 up to 12.5 wt.%, have been prepared by casting method. Studies were carried out utilizing FT-IR, UV/vis, fluorescence, TGA and DC electrical conduction to characterize the structural, optical and thermal properties of the films before and after irradiation. Results revealed that the structural and chemical characterizations of PMMA films are affected by the addition of chlorophyll and increasing dose of gamma-irradiation. FT-IR analysis revealed that the hydroxyl and carbonyl groups were responsible for the decrease of the bands intensities with increasing the dose rate up to 100 kGy. The change in these groups was attributed to competitive processes: decomposition with ester group abstraction and oxidation with formation of new oxidized carbonyls in the polymeric chains. The values of optical energy gap for the samples were decreased upon irradiation; this indicates that there is a charge transfer complexes arise between PMMA and chlorophyll. TGA analysis shows that the addition of chlorophyll to PMMA films enhances their thermal stability. The electric conduction data were interpreted on the basis of an intrachain one-dimensional interpolaron hopping model of Kuivalainen.

Accession Number: WOS:000274153800009

Document Type: Article

Language: English

Author Keywords: PMMA; Chlorophyll; gamma-Irradiation; FT-IR; UV/vis; TGA

KeyWords Plus: POLY(METHYL METHACRYLATE); ELEVATED-TEMPERATURES; LIGHT; PHOTODEGRADATION; DEGRADATION; RADIATION

Reprint Address: Elashmawi, IS (reprint author) Natl Res Ctr, Div Phys, Dept Spect, Giza, Egypt .

Publisher: ELSEVIER SCIENCE BV, PO BOX 211, 1000 AE AMSTERDAM, NETHERLANDS

Web of Science Categories: Chemistry, Physical; Materials Science, Coatings & Films; Physics, Applied; Physics, Condensed Matter

Research Areas: Chemistry; Materials Science; Physics

IDS Number: 550TT

ISSN: 0169-4332

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