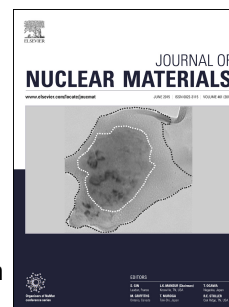


Accepted Manuscript

Iron phosphate glasses: Bulk properties and atomic scale structure

Kitheri Joseph, Martin C. Stennett, Neil C. Hyatt, R. Asuvathraman, Charu L. Dube, Amy S. Gandy, K.V. Govindan Kutty, Kenny Jolley, P.R. Vasudeva Rao, Roger Smith



PII: S0022-3115(16)31096-0

DOI: [10.1016/j.jnucmat.2017.07.015](https://doi.org/10.1016/j.jnucmat.2017.07.015)

Reference: NUMA 50387

To appear in: *Journal of Nuclear Materials*

Received Date: 10 November 2016

Revised Date: 30 June 2017

Accepted Date: 6 July 2017

Please cite this article as: K. Joseph, M.C. Stennett, N.C. Hyatt, R. Asuvathraman, C.L. Dube, A.S. Gandy, K.V. Govindan Kutty, K. Jolley, P.R. Vasudeva Rao, R. Smith, Iron phosphate glasses: Bulk properties and atomic scale structure, *Journal of Nuclear Materials* (2017), doi: 10.1016/j.jnucmat.2017.07.015.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Iron phosphate glasses: Bulk properties and atomic scale structure

Kitheri Joseph^{1,*}, Martin C. Stennett², Neil C. Hyatt², R. Asuvathraman¹, Charu L. Dube², Amy S. Gandy², K. V. Govindan Kutty¹, Kenny Jolley³, P. R. Vasudeva Rao¹, Roger Smith³,

¹Chemistry Group, Indira Gandhi Centre for Atomic Research, Kalpakkam, Tamil Nadu, India, 603 102

²Department of Materials Science & Engineering, The University of Sheffield, Mappin Street, Sheffield S1 3JD, UK

³Department of Mathematical Sciences, Loughborough University, Loughborough LE11 3TU, UK

Abstract

The bulk properties such as glass transition temperature, density and thermal expansion of iron phosphate glass compositions, with replacement of Cs by Ba, are investigated as a surrogate for the transmutation of ¹³⁷Cs to ¹³⁷Ba, relevant to the immobilisation of Cs in glass. These studies are required to establish the appropriate incorporation rate of ¹³⁷Cs in iron phosphate glass. Density and glass transition temperature increases with the addition of BaO indicating the shrinkage and reticulation of iron phosphate glass network. Average thermal expansion coefficient reduces from $19.8 \times 10^{-6} \text{ K}^{-1}$ to $13.4 \times 10^{-6} \text{ K}^{-1}$, when 25 wt. % of Cs₂O was replaced by 25 wt. % of BaO in caesium loaded iron phosphate glass. In addition to above bulk properties, the role of Ba as a network modifier in the structure of iron phosphate glass is examined using various spectroscopic techniques. The Fe^{II} content and average coordination number of iron in the glass network was estimated using Mössbauer spectroscopy. Fe^{II} content in the un-doped iron phosphate glass and barium doped iron phosphate glasses were 20, 21 and 22 ± 1 % respectively and the average Fe coordination varied from 5.3 ± 0.2 to 5.7 ± 0.2 with increasing Ba content. The atomic scale structure was further probed by Fe K-edge X-ray absorption spectroscopy. The average coordination number provided by extended X-ray absorption fine structure spectroscopy and X-ray absorption near edge structure was in good agreement with that given by Mössbauer data.

*Corresponding author; joskit@igcar.gov.in ; Fax: + 91 44 2748 0065

Download English Version:

<https://daneshyari.com/en/article/5454104>

Download Persian Version:

<https://daneshyari.com/article/5454104>

[Daneshyari.com](https://daneshyari.com)