JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

# By using Phy-X Software in $P_2O_5$– $Al_2O_3$ – MO glass systems doped with $Tm_2O_3$

***P. Vijaya Lakshmi[1]**

[2]Department of Physics, Sir C.R.Reddy College Of Engineering (A), Eluru -534007

**Abstract :** The present prepared glass samples P2O5– Al2O3 – MO(MO= Li, Na and K) glass systems doped with Tm2O3 . The XRD spectra confirms the glassy nature of the present prepared glass samples.By using Phy-x software we can found MAC&LAC values, HVL&TVL values, MFP&Neff values, ACS&ECS values of present prepared glass samples.

**Keywords :** Phy-x software,MAC &LAC , HVL&TVL , MFP&Neff , ACS&ECS values

## 1.Introduction

Alumino based glasses have excellent thermal and mechanical features, so they are used in different applications. One of these applications is the radiation shielding field. Radiation shielding materials are materials designed to attenuate the X-ray and gamma radiations or other types of radiation [1-3]. These materials are used to protect the human and environment from the hazard of the ionizing radiation. Lead and concrete are the two most popular materials used as radiation shields [4,5]. In addition, glasses in the current days are widely in the radiation shielding applications for many reasons. Glasses can be produced in different ways such as melt quenching method. Glasses are transparent materials, so we can use glasses in radiological rooms. We can easily modify the composition of the glasses in order to get effective glasses in radiation protection [6-8]. All these reasons encourage the researchers to develop glasses in radiation protection utilizations [9]. Oxide-based glasses have various properties that make them useful for a variety of technical and medical imaging applications. The majority have a reasonably low glass transition, high thermal stability, sufficient levels of chemical and physical resistance, a low melting point, and a low crystallisation ability. Furthermore, the use of glasses with varied compositions has already been demonstrated [10, 11]. Advanced oxide glass with novel compositions could be developed for testing against a wide range of ionising radiation energies. A wide variety of oxide glasses have been prototyped for radiation-shielding purposes [12,13]. The optical and shielding properties of these glasses have encouraged many researchers to evaluate their feasibility

as alternative shielding materials for use in radiation facilities in medical centres, x-ray and nuclear facilities in technical sectors, x-ray rooms, gamma camera rooms, and computed tomography (CT) scan units [13].

## 2. Experimental procedure

The glasses used for the present study are fabricated by the melting and quenching techniques. In this study, we computed all calculations using the recently developed Phy-X/PSD software, which has been used to compute several shielding factors at a wide range of ionizing radiation energies [10].

## 3. Results and Discussion

Figure .1 represents the XRD spectra of prepared glass samples. Figure .1 confirms the prepared glass samples glassy nature. Only one bump can be observed.We simulated the linear attenuation coefficient of the three prototyped radiation-shielding materials using Phy-X software, which involved irradiating each sample using a spectrum of mono-energetic gamma rays ranging between 0.01 and 15 MeV. Figure 2 illustrates that the behavior of both materials under radiation exposure depended on the incident gamma photons' energy, the LAC values for three different glasses (Li,Na,K) are 25.85,26.017 and 32.265 respectively (percentage difference = 6.24%). Similar behaviours were recognized for the recorded mass attenuation coefficient's values, the variation between both materials was a 6% difference approximately.

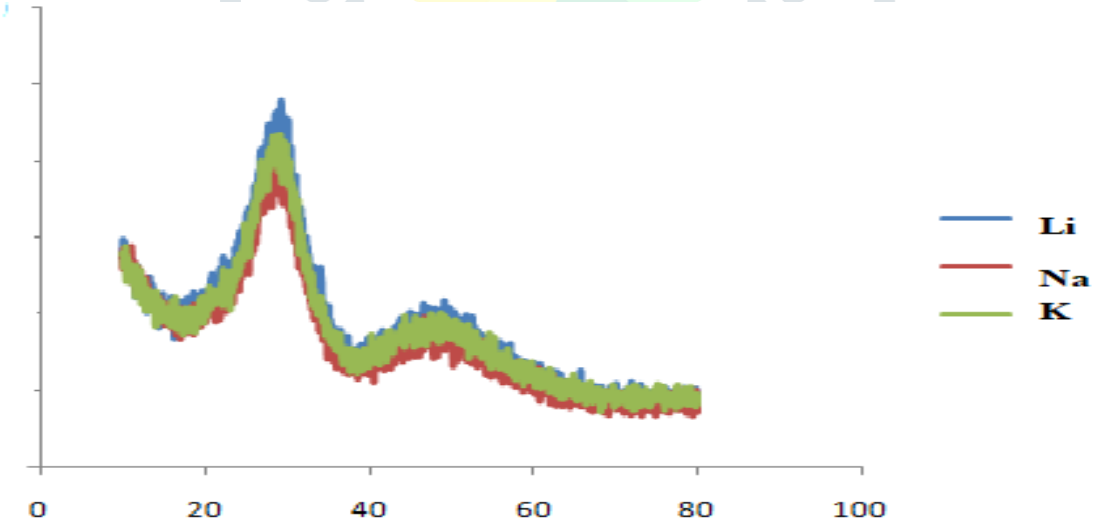


Fig 1.XRD spectra $P_2O_5$– $Al_2O_3$ – MO(MO= Li, Na and K) glass system

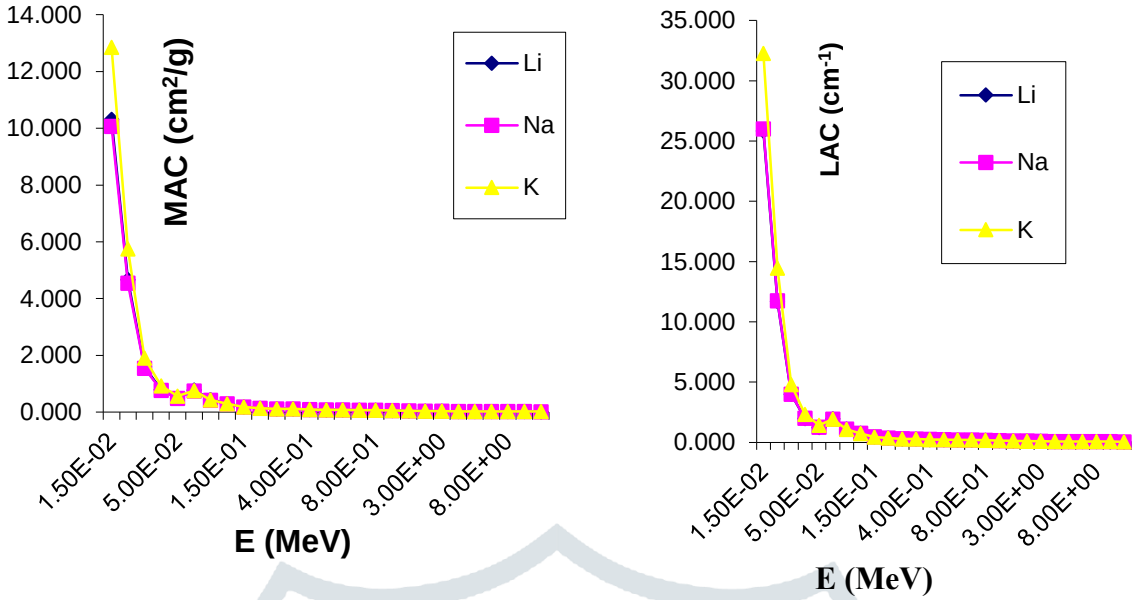


Fig 2.MAC&LAC values of $P_2O_5$– $Al_2O_3$ – MO(MO= Li, Na and K) glass system

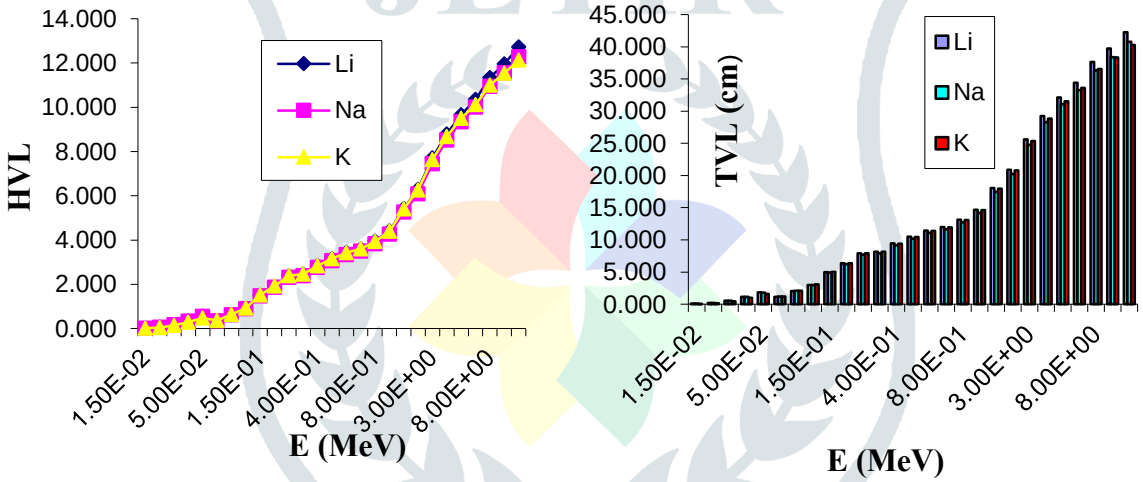


Fig 3.HVL&TVL values of $P_2O_5$– $Al_2O_3$ – MO(MO= Li, Na and K) glass system

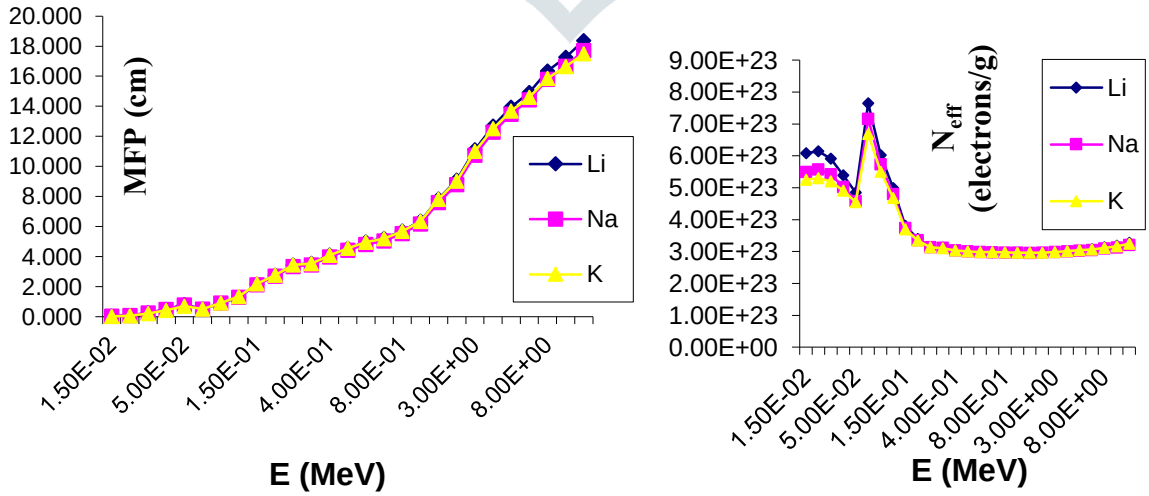


Fig 4.MFP&$N_{eff}$ values of $P_2O_5$– $Al_2O_3$ – MO(MO= Li, Na and K) glass system

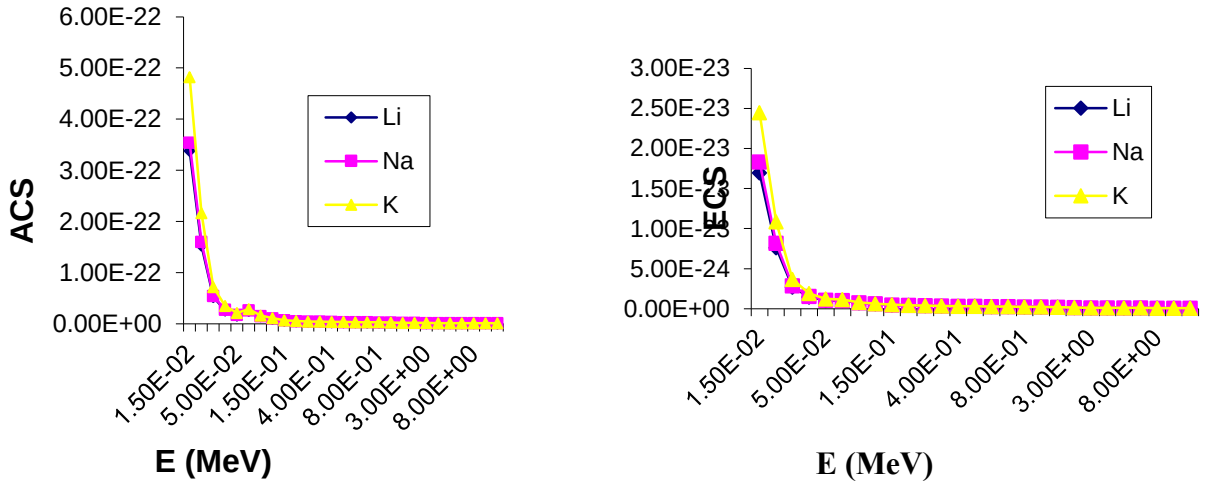


Fig 5.ACS&ECS values of $P_2O_5$– $Al_2O_3$ – MO(MO= Li, Na and K) glass system

Fig 3. Represents the values of HVL & TVL ranging from 0.027 to 12.729 and 0.089 to 42.285.Fig 4. Represents MFP&$N_{eff}$ values ranging from 0.089 to 18.364 and initially raised and finally constant values for all prepared glasses. Fig 5. represents ACS&ECS values slowly decreasing manner.

## 4. Conclusion

We report prepared glass samples with constant $Tm_2O_3$ ,modifying Li,Na &K estimated the Radiation Shielding parameters by using Phy-x Software.

## References

[1] Prasad, Rishu, Avinash R. Pai, S. Olutunde Oyadiji, Sabu Thomas, and S. K. S. Parashar. Journal of Cleaner Production 377 (2022): 134290.
[2] Özdemir, Tonguç, and Seda Nur Yılmaz. Radiation Physics and Chemistry 152 (2018): 17-22.
[3] Sayyed, M. I. Optik 270 (2022): 169973.
[4] Naseer, K. A., K. Marimuthu, K. A. Mahmoud, and M. I. Sayyed.The European Physical Journal Plus 136 (2021): 1-23.
[5] Kim, Seulgi, Yunhee Ahn, Sung Ho Song, and Dongju Lee. Composites Science and Technology 221 (2022): 109353.
[6] Saleh, Abdelmoneim.Progress in Nuclear Energy 154 (2022): 104482.
[7] Abualsayed, Mohammad Ibrahim. Radiochimica Acta 111, no. 3 (2023): 211-216.
[8] Bagheri, Reza, Alireza Khorrami Moghaddam, and Hassan Yousefnia. Nuclear Engineering and Technology 49, no. 1 (2017): 216-223.
[9] Acikgoz, Abuzer, Gokhan Demircan, Demet Yılmaz, Bulent Aktas, Serife Yalcin, and Nuri Yorulmaz. Materials Science and Engineering: B 276 (2022): 115519.
[10] E. Şakar, Ö.F. Özpolat, B. Alim, M.I. Sayyed and M. Kurudirek, Radiat. Phys. Chem. 166 (2020) 108496.
[11] E.-S.A. Waly, M.A. Fusco and M.A. Bourham, Ann. Nucl. Energy 96 (2016) 26.
[12] G. Lakshminarayana et al.J. Non-Cryst. Solids 471 (2017) 222.
[13] G. Lakshminarayana et al., Appl. Phys. A 126 (2020) 331.