

Broadband near infrared emission of Er³⁺ ions doped fluorophosphate glasses for solid state laser applications

P. Reddi Babu^a, N. Prasad^{a, b}, P. Pavithra^a, P. Chandra Sekhar^a, Vigilio de Carvalho dos Anjos^c, Anees A Ansari^d and B. Deva Prasad Raju^{a, *}

^aDepartment of Physics, Sri Venkateswara University, Tirupati-517 502, India.

^bDepartment of Physics, Adisankara College of Engineering & Technology, Gudur-524101, India.

^cUniversidade Federal de Juiz de Fora, Campus Universitário, SN - Juiz de Fora - MG Zip: 36036-330.

^dCollege of Science, King Saud University, Riyadh-11451, Saudi Arabia.

Corresponding author : [*drdevaprasadraju@gmail.com](mailto:drdevaprasadraju@gmail.com)

Abstract:

As phosphate glass doped with Er³⁺ can tune wavelength and laser linewidth narrower, as a result of its high conversion efficiency and ability to pump a large amount of energy, it is a suitable material for the fabrication of optical waveguide amplifiers and lasers, by employing the traditional melt - quenching approach. The fluorophosphate (P₂O₅ + Bi₂O₃ + Na₂CO₃ + SrF₂) glasses were prepared with different concentrations of trivalent Er³⁺ ions. X-ray diffraction, Fourier transform infrared spectroscopy, optical absorption, fluorescence emission spectra, and lifetime decay studies were carried out and analyzed. The oscillation strength of each band was estimated from the produced glasses' absorption spectra. The spectral intensity parameters ($\Omega_{\lambda} = 2, 4$ and 6) were estimated for the ⁴I_{13/2} → ⁴I_{15/2} transition using the Judd-Ofelt theory, along with other significant radiative factors including total radiative transition probability (A_T), radiative lifetime (A_R), and radiative branching ratios. This reduction could be the result of the concentration - quenching effect. The PBNSEr 05 glass sample may be used as a possibility for 1.53 μm solid state laser applications.

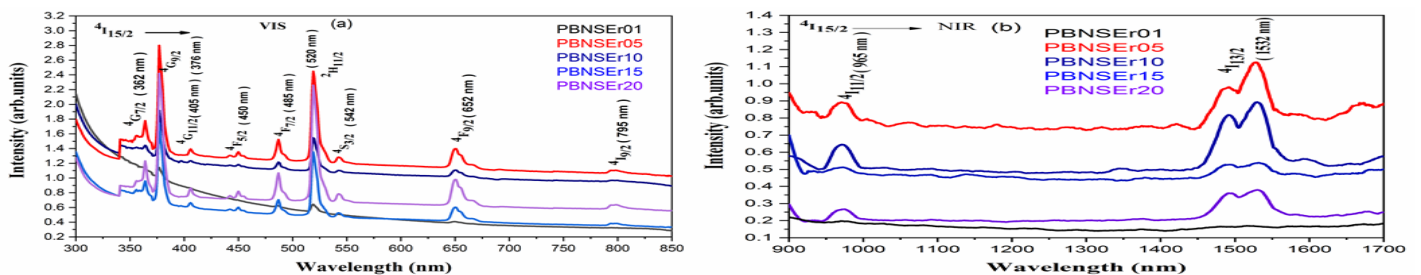


Fig.1(a, b) Optical absorption spectra of Er³⁺ doped PBNS glasses.

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References

- [1] L. Zur, M. Sołtys, T. Goryczka, J. Pisarska, W.A. Pisarski, Influence of PbF₂ concentration on thermal, structural and spectroscopic properties of Eu³⁺ doped lead phosphate glasses, *J. Mol. Struct.* 1075 (2014) 605–608. <http://dx.doi.org/10.1016/j.molstruc.2014.05.039>
- [2] F.H. ElBatal, M.A. Ouis, R.M.M. Morsi, S.Y. Marzouk, Interaction of gamma rays with some sodium phosphate glasses containing cobalt, *J. Non Cryst. Solids* 356 (2010) 46-55. <http://dx.doi.org/10.1016/j.jnoncrsol.2009.09.030>