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**Original Research Article**

# CHARACTERIZATION STUDES OF ERBIUM DOPED LITHIUM BORARE GLASS

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## Abstract
Optical properties of lithium borate glass with $Er^{+3}$ ions, prepared by the melt-quenching technique are investigated. The amorphous nature of prepared sampled was confirmed by XRD. The anaiysis of optical absorption spectra shows that the fundamental absorption edge is around 380nm. it is not sharply defined which characterizes the glassy nature of the samples. Absorption, excitation and emission spectra of all the samples were studies. The absorption peaks shows an increasing trend in intensity with the rare earth ion concentration which also confirms the incorporation of Er+3 in borate matrix. The direct and indirect band gap energies of all the sample were calculated and found that they are decreasing with increase in concentration of the dopant FWHM of the emission spectra in the visible region is found to be 10nm and the sharp peak indicates that this material can be used for laser studies

## Introduction
Integrated optical devices, including rare earth ions are attracting an increasing attention. Many trivalent rare earth ions such as $Er^{+3}$, $Tm^{+3}$ and $Pr^{+3}$ were doped as luminescent ions earlier in certain hosts. Among these rare earth ions, $Er^{+3}$ is recognized as an important ion in wave guide laser and up conversion lasser operations. Optical studies of $Er^{+3}$ are reported in different glass hosts as chlorophosphate. Chloroborate, sodium borate, and bismuth borate[1-3]. The realization of compact and low cost amplifiers is a challenge for telecommunication networks. The effect of the compositions and concentration on the spectroscopic properies of the $^4I_{13/2} \rightarrow {}^4I_{15/2}$ transition for $Er^{+3}$ ions in bismuth borate glasses are reported. Foldvari et al [4] studied visible range opitical absorotion of $Er^{+3}$ ions in yttrium aluminum borate(YAB) crystals which is a prtentia self-frequency-doubling laser host. The optical
Absorption and fluorescence spectra of $Er_2O_3$ glasses are also presented [5]. joshi et al [6] reported Energy transfer between optically excited $Dy^{3+}$ and $^{Er3+}$ ions in zinc pphosphate glass. preparation and characterization of sol gel derived $Er^{3+}$ Alplanar waveguides are also reported[7]. In the present work we prepared lithium borate glasses doped with different percentage of $Er_2O_3$ and have studied the optical absorption and fluorescence spectra. We also had done the optical band gap studies from the absorption edges.

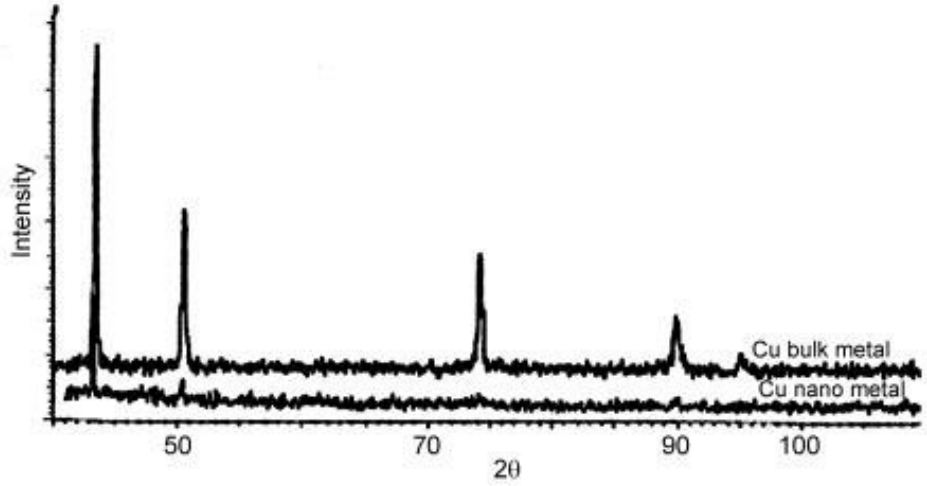
## Experimental
The akali mixed borate glass samples for the investigation were prepared with boric acid ($H_3BO_3$) as base element, lithium carbonate ($Li_2CO_3$) as modifier and erbium oxide ($Er_2O3$)as dopant Calculated amount of the chemicals are taken in a mortar and powdered well to obtain a homogeneous mixture. It then taken in a china dish and placed inside a high temperature Muffle furnace and heated up to 900˚C to melt the samples. Bubble free and homogeneous melt poured quickly to a preheated brass mould to obtain shaped glass samples and allowed to cool slowly. Good transparent bulk glass of thickness 1 mm was obtained. To obtain the thermal stability, the glass sample was annealed to 350’C for one hour. The samples were polished using water free lubricants

for commercial quality. Different samples were prepared with different dopant concentration as shown in the table 1.

The XRD spectrum of a doped representative sample 2 is recorded and ahown in fig. 1. The optical absorption spectra of all the samples with varying concentration of $Er^{3+}$ at room temperature

**Table 1: Wt % of chemicals of each sample**

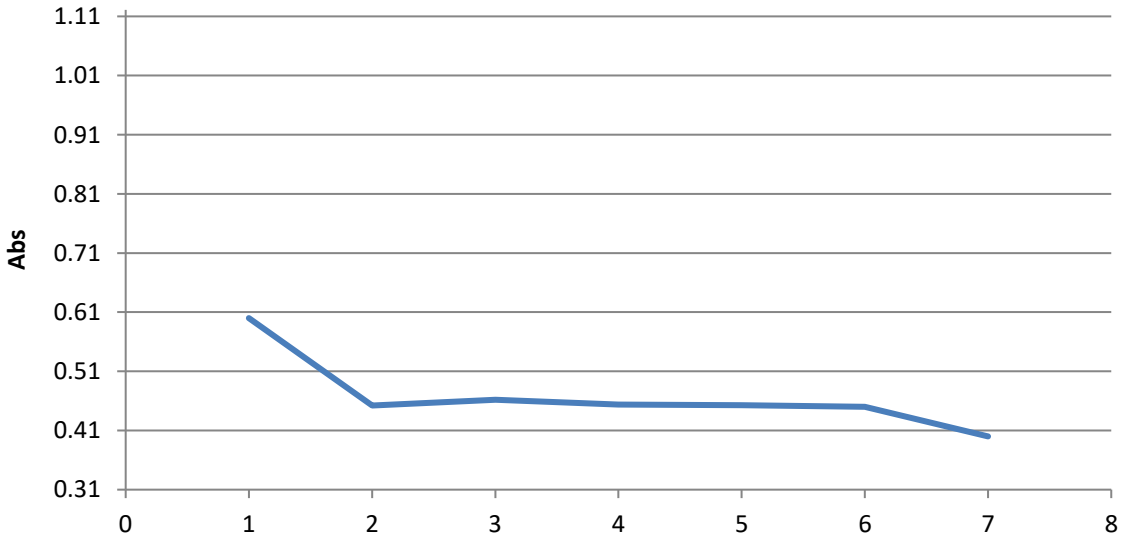
| Sample | $H_3BO_3$ (Wt %) | $Li_2CO_3$ (Wt %) | $Er_2O_3$ (Wt %) |
|---|---|---|---|
| 1 | 80 | 20 | 0 |
| 2 | 79.95 | 20 | 0.05 |
| 3 | 79.9 | 20 | 0.1 |
| 4 | 79.85 | 20 | 0.15 |




Are shown in fig. 2. Absorption spectra of the samples were recorded with Shimadzu uv-visible Spectrofluor photo meter (UVPC 2401). The excitation and emission spectra of spectra of samples were recorded in the Shimadzu Spectra fluorophotometer (RFPC 5301). All the sample show similar types of fluorescence spectra. fig. 4 represents excitation and emission spectra of sample 3. All measurement were done at room temperature and for the same instrument parameters.

Result and discussion

The glass samples were checked by X-Ray diffraction patten. The XRD shows irregular peaks which reveals that the planes in the samples are irregularly arranged indicating the absence of long



## Conclusion

Lithium borate glass doped with rare earth ion $Er^{3+}$ with technique. The amoephous nature of prepared samples was confirmed by XRD. The analysis of optical absorption spectra shows that the fundamental absorption spectra shows that the fundamental absorption edge is not sharply defined which characterizes the glassy nature of the sample. For all the samples the band edge was found to be around 380nm. The incorporation of $Er^{3+}$ inborate glass was confirmed by observing the absorption lines. The characteristic absorporation peaks show an increasing trend in intensity with the incorporation of $Er^{3+}$ in borate matrix. The direct and indirect band gap energies of all the samples were calculated and found that they are decreasing with increase in concentration of the dopant.

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