Full Length Research Article

INFLUENCE OF DYSPROSIUM CONCENTRATION ON LUMINESCENCE PROPERTIES OF LITHIUM BORATE GLASSES FOR YELLOW LASER APPLICATIONS

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ABSTRACT

Dy^{3+} doped lithium borate (LB) glasses with compositions (in mol %) (60-x) B_2O_3+ 20LiF + $10MgF_2$ + 10ZnO + xDy_2O_3 (where x = 0.1, 0.5, 1.0, 1.5 and 2 mol%) were prepared by melt quenching technique and have been investigated using structural measurements, optical absorption, luminescence, and decay kinetic techniques as well as Judd–Ofelt (J–O) analysis. The structure of host glass system can be accessed from XRD and Raman graphs. For these glasses, optical absorption, emission and decay measurements were carried out. From the optical absorption spectra, the spectral intensities (f) and Judd-Ofelt intensity parameters, Ω_λ (λ= 2, 4, 6) have been evaluated. From the photoluminescence spectra and using Judd-Ofelt intensity parameters, radiative transition probabilities (A_R), experimental branching ratios (β_{exp}), stimulated emission cross-sections (σ_e) and optical gain ($\sigma_e \times \tau_{exp}$) are calculated. To investigate luminescence efficiency of $^4F_{9/2}$ level of Dy^{3+} doped different lithium borate glasses, lifetimes (τ_{exp}) are predicted from decay curve analysis for all prepared Dy^{3+} doped lithium borate glasses glass matrices. Finally, these observed results were discussed and compared with the literature data and suggested for the yellow laser applications.

INTRODUCTION

In recent years, research on luminescent materials containing rare earth ions have been increased interest sharply due to their prospective applications in lasers, display devices, light emitting diodes and so on. Rare earth ions have some striking properties which makes attractive for researchers like low toxicity, photostability, high thermal and chemical stability, and sharp emission bands. For usefulness point of view, an optical device mainly depends on the luminescence intensity highly (Lu, 2014). This can be achieved by increasing doping concentration into host system. Even though number of researchers investigated in different host systems, still research is going on in this field for better optical device. As an important class of rare earth doped glass former i.e. the borate glass is promising candidate host material for rare earth ions because of its excellent thermal and chemical stability, UV to IR region transparency, low refractive index, and high emission cross sections (Bhushana Reddy, 2014). The origin of these properties has been strongly related to the local structure of boron atoms.

The coordination geometry of boron atoms is decided by the glass composition and the nature of glassy network modifiers. In order to dope high level of rare earth concentration in the host glass matrix, glass modifiers are added which breaks the bridging anion bonds thus increasing the nonbridging bonds. Alkali and alkaline earth oxides act as glass modifiers in the glass network former. Rare earth ions are cited in the vicinity of non-bridging oxygen bonds. The main disadvantage of these glasses is high phonon energy. In this context, fluorine content is added in the form of a variety of metal fluorides. Hence, fluoro-borate glasses, contain the properties of both fluoride and borate glasses (Venkatramu, 2006). Among, various rare earth ions, Dy^{3+} had been studied extensively for sensor, special band amplification and lasers. Materials doped with Dy^{3+} were investigated for white light emission due to emission lines consists of primary colours (Chemingui, 2015). In order to get good and suitable characteristics for practical purposes, to know the influence of glass host as well as doping concentration is essential. The present article reports the spectroscopic properties of a series dysprosium doped lithium borate (LB) glasses with fixed glass composition and variation of doping concentration, obtained by optical absorption, photoluminescence (PL), and decay kinetics techniques. In order to predict radiative and emission properties such as radiative transition probabilities (A_R), branching ratios (β),

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emission cross-sections (σ_e) and optical gain ($\sigma_e \times \tau_{exp}$) for certain emission transitions, Judd–Ofelt (J-O) analysis has been carried out. The present work mainly focused on the search of suitable Dy^{3+}-doped glassy like optical materials, which exhibit superior optical and radiative properties. Recently, Hashim *et at*. (Hashim, 2015) studied luminescence characteristics of lithium borate glasses doped with Dy^{3+} as a solid TL detector and concluded that the PL enhancement for the blue emission is observed up to 0.5 mol% of Dy^{3+} contents and quenching thereafter doping level. Meza-Rocha et al. (2016) investigated white light generation through zinc phosphate glasses doped with Eu^{3+} and Dy^{3+} and remarked that white light emission is obtained mainly due to $^5D_0 \rightarrow ^7F_2$ and $^4F_{9/2}$-$^6H_{15/2,13/2}$ emissions of Eu^{3+} and Dy^{3+}, respectively, being Eu^{3+} sensitized by Dy^{3+} through a non-radiative energy transfer. Mhareb *et al*. (2016) studied effect of Dy_2O_3 impurities on the physical, optical and TL properties of lithium borate glass.

Experimental

Lithium borate (LB) glass compositions with 0.1, 0.5, 1.0, 1.5 and 2.0 mol% of Dy^{3+} ions were prepared by melt quenching technique, and the precursor powders boric acid (B_2O_3), lithium fluoride (LiF), magnesium fluoride (MgF_2), zinc oxide (ZnO), dysprosium oxide (Dy_2O_3) (purity 99.9%) obtained from Himedia were used. The details of prepared glass composition as follows

LBDy01: $59.9B_2O_3 + 20LiF + 10 MgF_2 + 10ZnO + 0.1Dy_2O_3$
LBDy05: $59.5B_2O_3 + 20LiF + 10 MgF_2 + 10ZnO + 0.5Dy_2O_3$
LBDy10: $59.0B_2O_3 + 20LiF + 10 MgF_2 + 10ZnO + 1.0DY_2O_3$
LBDy15: $58.5B_2O_3 + 20LiF + 10 MgF_2 + 10ZnO + 1.5Dy_2O_3$
LBDy20: $58.0B_2O_3 + 20LiF + 10 MgF_2 + 10ZnO + 2.0Dy_2O_3$

The powders were weighed in stoichiometric amount and grinded in agate mortar. The grinded powders were taken in porcelain crucible and placed in electric furnace at 1100 ^{O}C for heating about 1 hour. After that, obtained liquid is poured on a preheated brass plate. The synthesized glass samples were subsequently annealed at 250 ^{O}C to remove thermal strains to do spectral measurements. Refractive index (n) measurements were performed using an Abbe refract meter at sodium wavelength (583.3 nm) with one-bromonapthalene as contact liquid. The density (d) was measured by Archimedes's principle using water as an immersion liquid. The prepared glasses were characterized for structural properties by using an X-ray diffract meter (XRD, SEIFERT). Vibrational groups were noticed from Raman spectrum of host glass matrix. Optical properties of the lithium borate glasses were analyzed by measuring absorption, excitation, and emission spectra. Absorption spectra were measured by using a UV-VIS-NIR spectrophotometer (ELICO SL 218). Excitation, emission spectra and decay profiles were measured by using JOBIN YVON Fluorolog-3 Spectrofluorimeter excited with xenon lamp. All the spectral measurements were carried out at room temperature.

RESULTS AND DISCUSSIONS

X-ray diffractogram (XRD) and Scanning Electron Microscopy (SEM)

The XRD diffractogram of the lithium borate host glass system is shown in Fig. 1. Obviously, the amorphous character of this host glass matrix is evident from XRD pattern. Only a broad

peak is observed in the region around $20° < 2\theta_o < 30$ for a glass sample free from dysprosium and indicating that these lithium borate glass samples are composed of glassy phase.
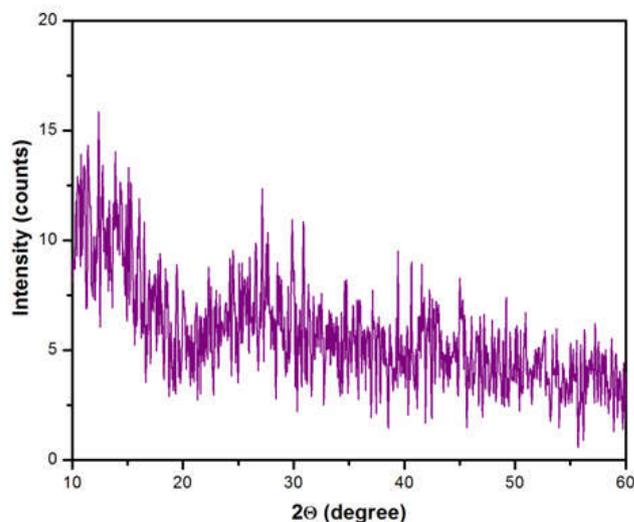
Fig.1. XRD spectrum of lithium borate host glass matrix

Raman spectrum

Structural assessment can be studied by Raman spectral measurement. The Raman spectrum of host glass matrix is recorded in the region 300-2000 cm^{-1} and is shown in Fig. 2. In order to know the exact structural units, Raman spectrum is deconvoluted into peaks by Gaussian fitting. Based on width, position and no of bands, it is fitted well. In Fig.2, black line is original spectrum, red line is after fitting process to Gaussian line and greens lines are deconvoluted bands. It is observed that the red line is coincided well with original line and indicating that the fitting process is reliable and less deviation. Raman band at 492 cm^{-1} is ascribed to penta, tetra and diborate rings.
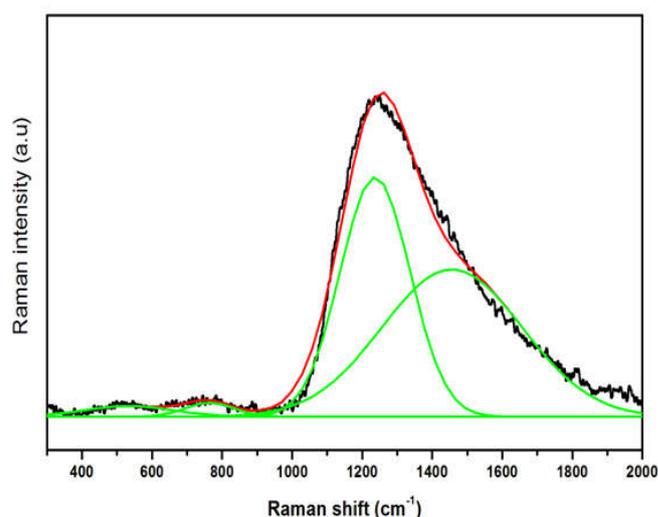
Fig. 2 Raman spectrum of lithium borate host glass matrix

The band at 755 cm^{-1} arises due to the symmetric stretching vibrations of di-triborates, triborates, tetraborates, and pentaborates, and of the various six-membered ditriborate rings. The bands at about 1230 cm^{-1} indicate that presence of symmetric stretching vibration of B–O–B bridges and terminal B–O pyroborate units are present in the structure of borate

glasses. If an oxide-modifier content is less than 50 mol%, the Raman shift at 1468 cm^{-1} originates also from the contribution of asymmetric stretching triangles of various borate groups [8-12].

Optical absorption analysis

The absorption spectrum of 0.5 mol% of Dy_2O_3 doped LB glass matrix is recorded in UV-VIS and NIR regions and is shown in Figs. 3a and 3b, respectively. The spectrum in the NIR region has most intense band, $^6F_{11/2}+^6H_{9/2}$ is centered at 7874 cm^{-1}. The transition from the ground state $^6H_{15/2}$ to ^6H and ^6F terms are spin allowed (S=0). Moreover, the transitions within ^6H term are also allowed by the orbital angular momentum selection rule, L=0 and hence, the transitions lying in the NIR region are intense.
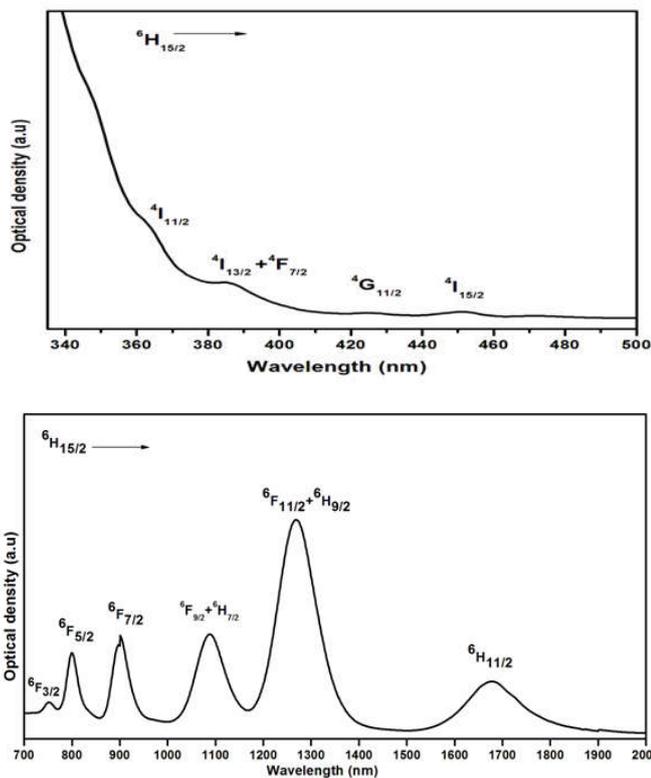
Fig. 3 (a) UV-VIS (b) NIR absorption spectrum of 0.5 mol% of Dy^{3+} doped lithium borate glass matrix

The spectral intensities of both f_{exp} & f_{cal} of 0.5 mol% of Dy_2O_3 doped LB glass matrix are calculated along with root mean square deviations δ_{rms} between them and is presented in Table 1. The experimental spectral intensities (f_{exp}) for the observed absorption bands were evaluated using the equation given in Ref. [13], while the theoretical spectral intensities (f_{cal}) were calculated based on Judd-Ofelt (J-O) theory [14, 15]. It is observed from Table 1 that, of different electronic transitions, $^6H_{15/2} \rightarrow {}^6F_{11/2}+^6H_{9/2}$ has high spectral intensities i.e. 11.11x10^{-6} confirms that higher asymmetry and coordination environment around Dy^{3+} atoms. The J-O intensity parameters, Ω_λ (λ=2, 4, 6) are often used to investigate a local structure and bonding in the site of rare earth ions. From spectral intensities, the J-O intensity parameters are obtained. Ω_2 parameter has been estimate asymmetry and covalency between rare earth cations and ligand anions. Ω_4 and Ω_6 parameters gives on rigidity, bulk property of the media and the vibronic transitions of the RE ions [16]. J-O intensity parameters have been calculated by J-

O theory using squared reduced matrix elements and are presented in Table 2. It is be noticed from Table 2, Ω_2 parameter is 9.30x10^{-20} cm^2. It is worthy to note that these glasses have higher covalency when compared to other glasses such as tellurite [17], aluminofluoro -borophosphate [18], Oxyfluorotellurite [19] and zinc–sodium–aluminosilicate [20] glasses. But lower covalency compared to LGBiBDy1.5 [21] glass. The trend of J-O parameters is: $\Omega_2 > \Omega_4 > \Omega_6$ for LB05Dy glass matrix.

Table 1. The oscillator strengths or spectral intensities (×10^{-6}) of 0.5 mol% Dy^{3+} doped for LB05Dy glass matrix

Transition $^6H_{15/2} \rightarrow$	f_{exp}	f_{cal}
$^4I_{13/2}+^4F_{7/2}$	4.18	3.94
$^4G_{11/2}$	0.24	0.14
$^4I_{15/2}$	0.73	0.82
$^4F_{9/2}$	0.26	0.25
$^6F_{3/2}$	0.41	0.32
$^6F_{5/2}$	2.44	1.92
$^6F_{7/2}$	3.27	3.08
$^6F_{9/2}+^6H_{7/2}$	4.16	4.01
$^6F_{11/2}+^6H_{9/2}$	11.11	11.17
$^6H_{11/2}$	2.07	2.27
δ_{rms}		$\pm0.53\times10^{-6}$

Table 2. A comparison of J–O intensity parameters (Ω_λ, ×10^{-20} cm^2) of 0.5 mol% of Dy^{3+} - doped LB05 glass matrix and other different glasses

Glass	Ω_2	Ω_4	Ω_6	Order	Reference
LB05	9.30	3.07	2.41	$\Omega_2>\Omega_4>\Omega_6$	Present work
Tellurite	6.91	0.99	1.01	$\Omega_2>\Omega_6>\Omega_4$	[17]
Aluminofluoro - borophosphate	6.28	5.21	1.10	$\Omega_2>\Omega_4>\Omega_6$	[18]
Oxyfluorotellurite	2.32	0.64	4.64	$\Omega_2>\Omega_6>\Omega_4$	[19]
zinc–sodium–aluminosilicate	0.54	0.10	0.03	$\Omega_2>\Omega_4>\Omega_6$	[20]
LGBiBDy1.5	13.63	13.41	3.53	$\Omega_2>\Omega_4>\Omega_6$	[21]

Luminescence spectra

The excitation spectrum of 0.5 mol% Dy_2O_3 doped lithium borate glass matrix is recorded in the spectral range from 300 to 500 nm at an emission wavelength of 573 nm and is shown Fig. 4. The excitation spectrum consist of seven inhomogeneous excitation peaks from ground state level $^6H_{15/2}$ to the excited states located at 325 nm ($^4K_{15/2}$), 350 nm ($^4M_{15/2}+$ $^6P_{7/2}$), 364 nm ($^4I_{11/2}$), 388 nm ($^4K_{17/2}+^4M_{19/2,21/2}+^4I_{13/2}+^4F_{7/2}$), 427 nm ($^4G_{11/2}$), 452 nm ($^4I_{15/2}$) and 471 nm ($^4F_{9/2}$). Among these excitation peaks, the excitation peak at 388 nm is relatively high in intensity and this is used for the measurements of luminescence spectra [4,5]. Figs. 5 shows the visible fluorescence spectra of different concentrations of Dy_2O_3 doped lithium borate glasses at an excitation wavelength (λ_{exc}) of 388 nm. When Dy^{3+} ions are excited under 388 nm from the ground state $^6H_{15/2}$ to the levels of higher energy $^4I_{13/2}+^4F_{7/2}$, then they decay non-radiatively (NR) from $^4I_{13/2}+^4F_{7/2}$ level to the $^4F_{9/2}$ meta stable state due to very small energy gap between the adjacent energy levels. As the energy gap between the $^4F_{9/2}$ excited level and its lower level $^6F_{3/2}$ is sufficiently large. Hence, the radiative emission is predominant over non-radiative emission. The emission spectra exhibiting three prominent emission transitions $^4F_{9/2} \rightarrow {}^6H_J$ (J=15/2, 13/2, and 11/2) which are observed nearly at 484, 573 and 663 nm respectively. The yellow (Y) emission transition ($^4F_{9/2} \rightarrow {}^6H_{13/2}$) at 573 nm appears to be having high emission intensity and red emission

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transition ($^4F_{9/2} \rightarrow {}^6H_{11/2}$) at 663 nm appears to be having low intensity. The other blue (B) emission transition ($^4F_{9/2} \rightarrow {}^6H_{15/2}$) at 483 nm wavelengths appears to be having relatively medium in emission intensity [18, 19].
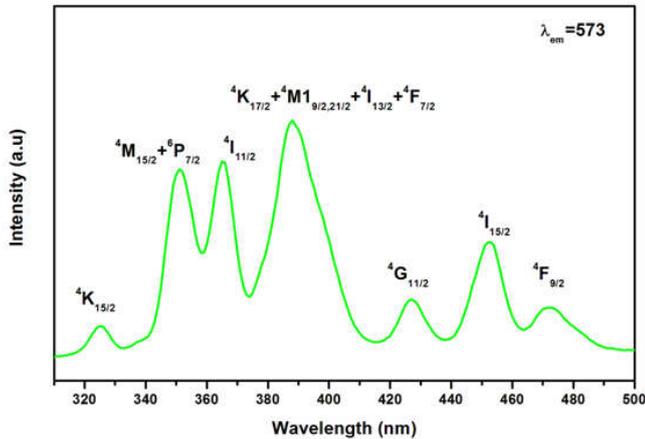
Fig. 4. Excitation spectrum of 0.5 mol% of Dy³⁺ doped lithium borate glass matrix
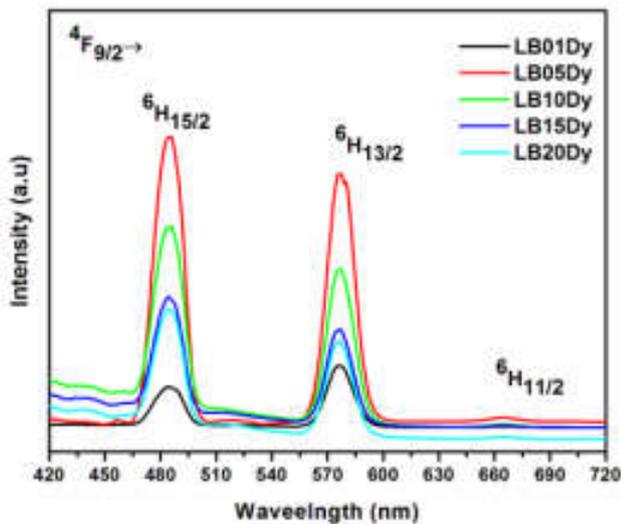
Fig. 5. Emission spectra of Dy³⁺ doped lithium borate glass matrix with different concentrations

The blue emission transition ($^4F_{9/2} \rightarrow {}^6H_{15/2}$) is a magnetic dipole (MD) transition. Hence, its intensity does not depend on the local crystal field environment of the constituent atoms in host matrix. Whereas, the yellow emission transition ($^4F_{9/2} \rightarrow {}^6H_{13/2}$) is an electric dipole (ED) transition ($\Delta L=2$, $\Delta J=2$). This transition is a hypersensitive emission transition. The intensity of this transition is measure of its local environment [20]. The intensity ratio, ED/MD is depicts how much asymmetric environment around dysprosium ions [32]. In the present work, yellow to blue ratio (Y/B) values are found to be 1.52, 0.88, 0.82, 0.78 and 0.72 for LB01Dy, LB05Dy, LB10Dy, LB15Dy and LB20Dy of LB glasses, respectively. Higher the value of Y/B ratio indicates higher degree of covalency. From the values of Y/B ratios, it is noticed that LB01Dy glass matrix has high degree of covalency and LB20Dy has low degree of covalency. With increasing of concentration, Y/B ratio decreases indicating that decreasing of it covalent character around Dy³⁺ atoms. In the present work, the intensity of ED is higher than MD which indicates more asymmetric environment and covalency, around dysprosium atoms at initial concentration (0.1 mol% of

Dy³⁺). The emission intensity of the peaks decreased with increase of Dy₂O₃ concentration (>0.5 mol% of Dy₂O₃). The emission intensity is higher for LB05Dy and lower for LB20Dy glass matrix. This quit in intensity depicts concentration quenching occurred above 0.5 mol % of Dy³⁺ concentration. As concentration of Dy₂O₃ increases from 0.5 to 2.0 mol%, the non-radiative energy transfer channels increases through existence of cross-relaxation and resonant channels.
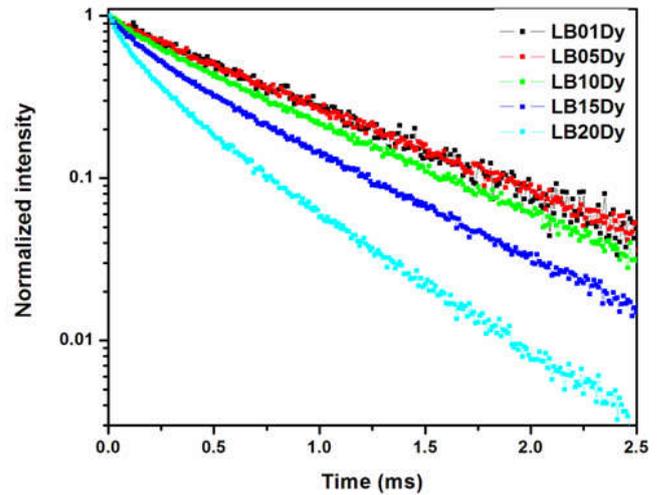
Fig. 6. Decay profiles of Dy³⁺ doped lithium borate glass matrix with different concentrations

The luminescence properties such as peak emission wavelengths (λ_P), effective bandwidths (λ_{eff}), branching ratios (β) (experimental), transition probability (A_R), peak emission cross-sections (σ_e) and optical gain ($\sigma_e \times \tau_{exp}$) for the three emission transitions $^4F_{9/2} \rightarrow {}^6H_J$ (J=15/2, 13/2, and 11/2) are calculated for LB05Dy glass matrix and are presented in Table 3. The equations are taken from Ref. [17] and calculated. The experimental fluorescence branching ratios (β_{exp}) are obtained from integrating each specific transition. The branching ratios (β) and peak emission cross-sections (σ_e) and optical gain ($\sigma_e \times \tau_{exp}$) are very important parameters to characterize the luminescence potentiality of the lasing transition. It is observed from Table 3 that, the branching ratios (β) of the emission transitions i.e. $^4F_{9/2} \rightarrow {}^6H_{13/2}$ and $^4F_{9/2} \rightarrow {}^6H_{15/2}$ have greater than the transition $^4F_{9/2} \rightarrow {}^6H_{11/2}$. The A_R value is found to be 871 s⁻¹ which is high for the $^4F_{9/2} \rightarrow {}^6H_{13/2}$ transition than $^6H_{15/2}$ (202 s⁻¹) and $^6H_{11/2}$ (89 s⁻¹). The σ_e is one of the important parameter used to identify a laser active medium. A good laser transition can has a large σ_e. σ_e is higher (18.95 x10⁻²² cm²) for the transition $^4F_{9/2} \rightarrow {}^6H_{13/2}$ than other two emission transitions $^4F_{9/2} \rightarrow {}^6H_{11/2}$ (4.32 x10⁻²² cm²) and $^4F_{9/2} \rightarrow {}^6H_{15/2}$ (6.17 x10⁻²² cm²). The largest σ_e values are attractive features for low threshold, high gain applications and are utilized to obtain continuous wave laser action. Optical gain ($\sigma_e \times \tau_{exp}$) is important one for lasing material. Their values signify that the laser threshold capacity of optical material. Its magnitudes are 4.87×10⁻²⁵ cm² –sec, 14.97×10⁻²⁵ cm² –sec, 3.41×10⁻²⁵ cm² –sec for the $^4F_{9/2} \rightarrow {}^6H_{15/2}$ and $H_{13/2}$ transitions respectively in LB05Dy glass system. Due to higher A_R, σ_e and $\sigma_e \times \tau_{exp}$ magnitudes in 0.5 mol% of Dy₂O₃ doped LB glass matrix (LB05Dy) for the $^4F_{9/2} \rightarrow {}^6H_{13/2}$ transition located at 588 nm may be suggested for yellow lasing material.

Decay curve analysis

The fluorescence decay profiles of $^4F_{9/2}$ emission level have been recorded at room temperature for different concentrations

of Dy_2O_3 doped LB glasses (0.1, 0.5, 1.0, 1.5 and 2.0 mol% of Dy_2O_3) with an excitation wavelength 388 nm and emission wavelength at 573 nm are shown in Fig.6. As can be seen from Fig.6, the decay rates are well described by a single exponential dependence for LB01Dy and LB05Dy glasses. At higher concentrations of Dy^{3+} ion (>0.5 mol%), the decays are non-exponentials. These non-exponential graphs are analyzed using Inokuti-Hirayama (I-H) model [17]. If they are fitted to s=6, s=8 and s=10 depicts dipole-dipole, quadruple-dipole, quadruple- quadruple nature respectively. In the present work, the graphs (for LB10Dy, LB15Dy and LB20Dy) are fitted to s=6 variable indicating that the type of interaction is dipole-dipole.

Table 3. Luminescence parameters of 0.5 mol% Dy^{3+} doped LBDy05 glass matrix

Parameters	$^4F_{9/2} \rightarrow {}^6H_{15/2}$	$^4F_{9/2} \rightarrow {}^6H_{13/2}$	$^4F_{9/2} \rightarrow {}^6H_{11/2}$
λ_p (nm)	484	573	665
$\Delta\lambda_{eff}$ (nm)	19	17	20
A_R (s^{-1})	202	871	89
β_{exp}	0.49	0.46	0.05
τ_{exp} (ms)	0.79	0.79	0.79
σ_e ($\times 10^{-22}$ cm^2)	6.17	18.95	4.32
$\sigma_e \times \tau_{exp}$ ($\times 10^{-25}$ cm^2-sec)	4.87	14.97	3.41

The non-exponential nature increases when the concentration is large enough for the interaction between Dy^{3+} and Dy^{3+} ions and the energy transfer processes enhance from a donor (excited Dy^{3+} ion) to an acceptor (ground Dy^{3+} ion). While at lower concentrations of Dy^{3+} ion, the interaction between Dy^{3+} and Dy^{3+} ions are negligible. The experimental lifetimes (τ_{exp}) of $^4F_{9/2}$ level are obtained from decay profiles and these are 0.80, 0.79, 0.65, 0.49 and 0.30 ms for LB01Dy, LB05Dy, LB10Dy, LB15Dy and LB20Dy glasses respectively and are presented for LB05Dy glass matrix in Table 3. It is observed that with the increase in concentration of Dy^{3+} ion, the τ_{exp} have decreased. The decrement in τ_{exp} indicates that the presence of non-radiative process. The decrease of τ_{exp} with increase of Dy^{3+} ion concentration is due to the energy transfer through cross-relaxation and resonant energy transfer between Dy^{3+} ions. The non-exponential nature of the decay profile for the $^4F_{9/2}$ emission level has been attributed to cross-relaxation processes from Dy^{3+} ions excited up to the $^4F_{9/2}$ level to nearby Dy^{3+} ions in the $^6H_{15/2}$ ground state.

Conclusion

Dy^{3+} ions doped lithium borate glasses with compositions (in mol %) (60-x) B_2O_3+ 20LiF + 10MgF$_2$ + 10ZnO + xDy$_2O_3$ (where x = 0.1, 0.5, 1.0, 1.5 and 2 mol%) were prepared by melt quenching technique and investigated using structural analysis, optical absorption, luminescence, and decay kinetics as well as Judd–Ofelt (J–O) analysis. For these glasses, X-ray diffraction (XRD), Raman, optical absorption, emission and decay measurements have been carried out. The glassy nature of the present glass matrices are confirmed by XRD profiles. From Raman spectrum various functional groups such as di, tri, tetra, penta- borate rings are observed. From the optical absorption spectrum, the spectral intensities and Judd-Ofelt intensity parameters, Ω_λ (λ= 2, 4, 6) have been evaluated. For LBDy05 glass system obtained Ω_2, Ω_4 and Ω_6 parameters magnitudes found to be 9.30×10^{-20}, 3.07×10^{-20} and 2.41×10^{-20} cm^{-2}, respectively. For 0.5 mol% Dy^{3+}- doped LB glasses, the Ω_λ trend has been observed as $\Omega_2>\Omega_4>\Omega_6$. Using Judd-Ofelt intensity parameters, radiative characteristics are calculated.

From the photoluminescence spectra, experimental branching ratios (β_{exp}), stimulated emission cross-sections (σ_P) and optical gain ($\sigma_e \times \tau_{exp}$) are calculated. Five samples are studied by varying concentration of dysprosium up to 2.0 mol%. Initially enhancement (up to 0.5 mol% Dy^{3+}) and then quenching in fluorescence emission intensities are due to the concentration effect of dysprosium ions and the involvement of an energy transfer (ET) process through cross relaxations (CR) at relatively higher concentration of active ion is observed.

This is known as concentration quenching. The A_R, σ_e, and $\sigma_e \times \tau_{exp}$ values are calculated for $^4F_{9/2}\rightarrow{}^6H_{13/2}$ transition in LB05Dy lithium borate glass. Reasonably high values of various radiative parameters evaluated for $^4F_{9/2}\rightarrow{}^6H_{13/2}$ (573 nm) transition suggest that the 0.5 mol% Dy^{3+}-doped LB05Dy glass is optimized LB glass system. The decay curves of the Dy^{3+}-doped different LB glasses are measured. Among all the LB glasses, LBDy01 has longer τ_{exp} and LBDy20 has shorter τ_{exp}. Due to increase in the dysprosium concentration, there is a possibility of decrement in distance between two active dysprosium centers and this leads to energy transfer between atoms. Finally, it is concluded that the prepared 0.5 mol% Dy^{3+} doped lithium borate glass system is might be useful for yellow laser applications.

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