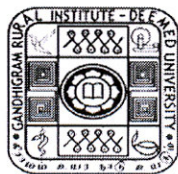


**DEPARTMENT OF PHYSICS**  
**RQC – Weekly Research Colloquium 2016 – 2017**  
**GANDHIGRAM RURAL INSTITUTE-DEEMED UNIVERSITY**  
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13-09-2017

Dear Sir / Madam,

All are invited for the weekly research seminar to be given by **Mr. M. Mariyappan**, Full time Research Scholar, Department of Physics, working under the guidance of **Dr. K. Marimuthu**, Asst. Professor, Department of Physics, GRI-DU.

**Topic :** “Structural and Luminescence Properties of  $Er^{3+}$  Ions Doped Bismuth Borate Glasses for  $1.53\mu m$  Broadband Optical Amplifiers”

**Date :** 14-09-2017


**Time :** 2:00 p.m.


**Venue :** Seminar Hall, Department of Physics, GRI-DU.

  
Head of the Department

**PROFESSOR AND HEAD**  
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Programme Coordinators

  
(Dr. K. Marimuthu)

  
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# Structural and Luminescence Properties of Er<sup>3+</sup> Ions Doped Bismuth Borate Glasses for 1.53µm Broadband Optical Amplifiers

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## Abstract

A new series of Er<sup>3+</sup> ions doped bismuth borate glasses were prepared with the composition (40-x)B<sub>2</sub>O<sub>3</sub>+ 20Bi<sub>2</sub>O<sub>3</sub>+20Na<sub>2</sub>O +20CaF<sub>2</sub>+xEr<sub>2</sub>O<sub>3</sub> (where x= 0.1, 0.25, 0.5, 1 and 2 in wt%). The structural and spectroscopic behaviors of the titled glasses have been examined through XRD, FTIR and absorption, luminescence, decay spectral analysis respectively. The XRD pattern reveals the amorphous nature the FTIR spectra explore the presence of various functional groups such as B–O asymmetric stretching of trigonal BO<sub>3</sub> units, B–O stretching of tetrahedral BO<sub>4</sub> units and vibrations of Bi–O<sup>-</sup> bond in the BiO<sub>6</sub> octahedral units. In order to examine the electronic band structure of the studied glasses, optical energy gap (E<sub>opt</sub>) and Urbach energy (ΔE) values were estimated from the absorption spectra. Luminescence spectra along with the Judd–Ofelt intensity parameters have been used to determine the various radiative properties like transition probability (A), stimulated emission cross-section (σ<sub>p</sub>), lifetimes (τ<sub>cal</sub>, τ<sub>exp</sub>), branching ratios (β<sub>R</sub>) and effective bandwidth (Δλ<sub>eff</sub>) for the <sup>4</sup>S<sub>3/2</sub> → <sup>4</sup>I<sub>15/2</sub> and <sup>4</sup>I<sub>13/2</sub> → <sup>4</sup>I<sub>15/2</sub> emission transitions and the results were discussed and reported. By employing the McCumber theory, absorption and emission cross-sections for the <sup>4</sup>I<sub>13/2</sub> → <sup>4</sup>I<sub>15/2</sub> transition (1.53 µm) were calculated for all the titled glasses. The decay curves of the <sup>4</sup>I<sub>13/2</sub> level have been measured and the fall in lifetime value with the increase in Er<sup>3+</sup> ion content have been studied through the energy transfer process takes place between the nearby Er<sup>3+</sup> ions.

**Keywords:** Oscillator Strengths; Bandgap; J–O intensity parameters; Radiative properties.