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Short Communication

Spectroscopic studies on Er3+-doped Al(PO3)3-BaF2-SrF2 fluorophosphate glasses

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Abstract

Statement of the Problem: For the past decades, erbium doped fiber amplifier (EDFA) has become a key element of modern telecommunication system due to Er^{3+} ion emission at 1.53 mm attributed to the $^4I_{13/2} \rightarrow {}^4I_{15/2}$ transition [1, 2]. The commercial EDFAs used in communication networks are made up of silica glass that has a relatively narrow bandwidth emission (~35 nm) resulting in a narrow gain curve, which limits its applications to meet broadband transmission. Among different host matrices, fluorophosphate (FP) glasses have received great interest for laser and optical amplifier applications because of their characteristic properties [3, 4]. Therefore, Er^{3+}-doped FP glasses can enlarge the emission cross-section and improve luminous efficiency because of the characteristic features of Er^{3+} ions and advantageous properties of mixed fluoride and phosphate glasses [5]. Hence, the present study carried out spectroscopic studies on Er^{3+}-doped FP glasses for different concentrations of Er^{3+}. Methodology: Er^{3+}-doped fluorophosphate glasses were prepared by a conventional melt quenching technique and were characterized through spectroscopic techniques. Findings: From absorption, emission and decay measurements, the important spectroscopic properties such as bandwidths, emission cross-sections and lifetime were evaluated for significant 1.53 mm emission band. The emission cross-section and lifetime were found to be of the order of $2.0´10^{-20}$ cm^2 and 10 ms, respectively. These desirable parameters are used to see the potentiality of the material for laser gain media. Conclusion & Significance: It was concluded that higher dopant Er concentration improved the 1.53 mm emission band characteristic properties. The results indicate that this glass composition can enable construction of short, highly efficient fiber or planar waveguide amplifiers. To efficiently extract the stored energy with low injection energy at low laser fluence operation and make the system compact, a bidirectional ring amplifier (BRA) with twin pulses is proposed. The characteristics of the bidirectional ring amplifier on energy flow, extraction efficiency and output energy capability are studied. The simulation results show that an extraction efficiency of 62.3% at the B integral limit can be obtained at low average fluence of 10.3 J/cm2 and the low injection energy of 3.9 mJ in the bidirectional ring amplifier. The output performance of the bidirectional ring amplifier with twin pulses is demonstrated.

Biography:

Linganna K received M.Sc and Ph.D degrees from the Department of Physics, Sri Venkateswara University, Tirupati, Andhra Pradesh, India in 2006 and 2012, respectively. His research activities involve preparation and characterization of rare earth doped glasses and glass fibers fabricated by melt quenching technique and fiber drawing processes, respectively, for the development of photonic devices such as lasers, optical amplifiers, sensors and so on. He also gained experience on waveguide inscription in rare earth doped glasses indigenously developed at Sri Venkateswara University, Tirupati, India for integrated optics. So far, he visited UK, Mexico for his Doctoral and Post-Doctoral research work. For the past five years, he has been working as a Post-Doctoral researcher in South Korea. He published his research work in international reputed journals besides presented his work in various international and national conferences/workshops/symposia.