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Spectroscopic and 1.08mm Laser Properties of Nd3+ Doped Oxy-Fluoro Borate Glasses

Authors : Swapna Koneru, Srinivasa Rao Allam, Vijaya Prakash Gaddem

Abstract : The different concentrations of neodymium-doped (Nd-doped) oxy fluoroborate (OFB) glasses were prepared by melt quenching method and characterized through optical absorption, emission and decay curve measurements to understand the lasing potentialities of these glasses. Optical absorption spectra were recorded and have been analyzed using Judd–Ofelt theory. The dipole strengths are parameterized in terms of three phenomenological Judd–Ofelt intensity parameters Ωλ (λ=2, 4 and 6) to elucidate the glassy matrix around Nd3+ ion as well as to determine the 4F3/2 metastable state radiative properties such as the transition probability (AR), radiative lifetime (τR), branching ratios (βR) and integrated absorption cross-section (σa) have been measured for most of the fluorescent levels of Nd3+. The emission spectra recorded for these glasses exhibit two peaks at 1085 and 1328 nm corresponding to 4F3/2 to 4I11/2 and 4I13/2 transitions have been obtained for all the glasses upon 808 nm diode laser excitation in the near infrared region. The emission intensity of the 4F3/2 to 4I11/2 transition increases with increase of Nd3+ concentration up to 1 mol% and then concentration quenching is observed for 2.0 mol% of Nd3+ concentration. The lifetimes for the 4F3/2 level are found to decrease with increase in Nd2O3 concentration in the glasses due to the concentration quenching. The decay curves of all these glasses show single exponential behavior. The spectroscopy of Nd3+ in these glasses is well understood and laser properties can be accurately determined from measured spectroscopic properties. The results obtained are compared with reports on similar glasses. The results indicate that the present glasses could be useful for 1.08 μm laser applications.

Keywords : glasses, luminescence, optical properties, photoluminescence spectroscopy
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