OPTICAL SPECTROSCOPY OF THE Er-DOPED GLASSES WITH 3CaO-Ga₂O₃-3GeO₂ COMPOSITIONS

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The development of Er³⁺ lasers and amplifiers in optical fibres for telecommunications gives rise the intensively spectroscopic investigations of the Er-doped glasses and crystals. In the present work for the first time the absorption, emission and luminescence excitation spectra as well as the luminescence kinetics of the Er³⁺ ions (amount of Er – 0.7 wt.% in glasses with garnet Ca₃Ga₂Ge₃O₁₂ (or 3CaO-Ga₂O₃-3GeO₂) composition were investigated in the UV – visible spectral range. The samples for investigation were prepared by conventional high-temperature synthesis according to [1]. The short-range order structure in the glasses of CaO-Ga₂O₃-GeO₂ system is described in [2].

By optical and electron paramagnetic resonance (EPR) spectroscopy it was shown that the erbium is incorporated into the glass network as Er³⁺ ions (4f¹¹ – electron configuration, ⁴I₁⁵/₂ – free-ion ground state), exclusively. All observed transitions of the Er³⁺ ions in the UV – visible optical spectra of the Er-doped glasses with 3CaO-Ga₂O₃-3GeO₂ compositions are identified. The observed Er³⁺ optical spectra can be analysed in the framework of the Judd-Ofelt theory. Optical spectra of the Er³⁺ ions in the 3CaO-Ga₂O₃-3GeO₂ glasses are quite similar to Er³⁺ optical spectra in other oxide glasses and disordered crystals and are characterised by statistically distributed local crystal field parameters. The Er³⁺ luminescence decay curves can be satisfactory described by two exponential approximation with lifetimes τ₁ = 10.6 µs and τ₂ = 22.4 µs, obtained for ⁴S₃/₂ → ⁴I₁₅/₂ transition (λₘₐₓ=555 nm) at room temperature. The peculiarities of spectroscopic properties and luminescence kinetics for Er³⁺ ions in the CaO-Ga₂O₃-GeO₂ glass network in comparison with other Er-doped glasses and crystals are discussed.

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References