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Structural and fluorescence properties of Ho^{3+}/Yb^{3+} doped germanosilicate glasses tailored by Lu_2O_3

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ABSTRACT: Structural and fluorescence properties of Ho^{3+}/Yb^{3+} co-doped germanosilicate glasses have been modified by tailoring the composition using lanthanide additive Lu_2O_3. Raman spectra and X-ray Photoelectron spectra reveal that the addition of Lu_2O_3 can change the structure by increasing non-bridging oxygens (NBO) in this glasses. Meanwhile, an improved thermal stability (ΔT: from 110 to 187 ˚C) has also been obtained via Lu^{3+} 'lanthanide contraction'. Futhermore, the positive effect of changed glass structure gives excellent fluorescence properties by the decreasing cross relaxation process which are proved by the experimental upconversion, near-infrared and mid-infrared fluorescence spectra. Additionally, a double enhancement of a 2.0 μm emission has been achieved successfully in this silica-germanate glass with 7 mol% Lu^{3+} addition, which possesses a larger emission cross section (4.41×10^{-21} cm^2) at 2022 nm. These results indicate that the optimized emission of Ho^{3+} for optical fiber laser can be achieved by tuning the glass structure using lanthanide additive Lu_2O_3.

Keywords: Germanosilicate glasses; Lanthanide additive Lu_2O_3; NBO and BO; Energy transfer.