1.5-μm Emission and Infrared-to-Visible Upconversion Luminescence of Er^{3+}/Yb^{3+} in Oxyhalide Glasses for Broadband Fiber Amplifiers and Waveguide Lasers

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ABSTRACT

We report on the spectroscopic properties of the 1.5-μm emission from $^4I_{13/2} \rightarrow {}^4I_{15/2}$ transition of Er^{3+}/Yb^{3+}-doped oxyhalide tellurite glasses for applications in broad-band fiber amplifiers and waveguide lasers. The intensity profile of the emission peak at ~1530 nm, has revealed a full width at half-maximum of ~70 nm. The measured lifetime and emission cross-section of this transition are ~3.1 ms and ~7.9×10^{-21} cm^2, respectively. Frequency upconversion occurs simultaneously upon excitation of the 1.5-μm emission with a 978 nm laser diode. Three intense emissions centered at around 529, 546 and 657 nm, alongwith a very weak blue emission at 410 nm have clearly been observed and the involved mechanisms are explained. The quadratic dependence of fluorescence on excitation laser power confirms the fact that the two-photons contribute to the green-red upconversion emissions. And the blue upconversion at 410 nm involved a sequential three-photon absorption process.

Keywords: Optical materials and properties; Er^{3+} doped oxyhalide glasses; Up-conversion.

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