

Abstract

1.5–2.1 mm Emission in Rare-Earth Co-Doped Glasses and Multicore Optical Fibers [†]

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Abstract: Ultra-broadband emission in the range of 1.0–2.1 mm is required in medicine (OCT), metrology, and sensing systems. Novel ideas are connected to the rare-earth co-doping of low-phonon energy glasses (further fiber core) and ultra-broad emissions obtained as a result of the superposition of particular luminescence bands. The 1.5–2 μm broadband ASE in both germanate glasses and glass fibers co-doped with Tm³⁺/Ho³⁺, Yb³⁺/Tm³⁺/Ho³⁺ and Er³⁺/Tm³⁺/Ho³⁺ can be realized as a result of radiative transitions in the 1.4–2.1 mm range due to Tm³⁺: ³H₄→³F₄ (1.45 mm), Er³⁺: ⁴I_{13/2}→⁴I_{15/2} (1.55 mm), Tm³⁺: ³F₄→³H₆ (1.8 mm), and Ho³⁺: ⁵I₈→⁵I₇ (1.55 mm) transitions and the partial donor–acceptor energy transfer and superposition of the particular emission bands. This work presents two important issues: (1) the optimization of the co-dopant concentration in germanate glasses and the construction of double-clad, multicore fibers to obtain flat broadband emission in the 1.5–2.1 mm range; (2) the development of the multicore glass–ceramic optical fibers co-doped with rare-earth and d-block metals, which enables the extension of the emission band. The effect of the rare-earth concentration on the donor–acceptor energy transfer and, finally, obtaining broadband luminescence in glasses co-doped with Er³⁺/Tm³⁺/Ho³⁺, Yb³⁺/Tm³⁺/Ho³⁺ and glass–ceramics co-doped with Ni²⁺/Er³⁺ will be presented. Constructions of the multicore characterized by broadband, eye-safe ASE will be also analyzed.

Keywords: broadband luminescence; multicore optical fiber; germanate glass



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