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Up-conversion luminescence in germanate glass and double-clad optical fibre co-doped with Yb³⁺/Eu³⁺ ions

Kochanowicz, M.; Zmojda, J.; Ragin, T.; Miluski, P.; Jelen, P.

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Abstract:

In the paper the analysis of up-conversion (UC) luminescence in 0.5Yb₂O₃/(0.25-1)Eu₂O₃ (mol.%) co-doped germanate glass and optical fibre has been investigated. Up-conversion emission of bands at 591, 616, 652, 701 nm to which correspond Eu³⁺: ⁵D₀ → ⁷F₁, ⁵D₀ → ⁷F₂, ⁵D₀ → ⁷F₃, ⁵D₀ → ⁷F₄ transitions, respectively was obtained as a result of cooperative energy transfer between Yb³⁺ and Eu³⁺ ions. The highest up-conversion emission (Yb³⁺ → Eu³⁺ energy transfer efficiency η = 24%) was obtained in 0.5Yb₂O₃/0.75Eu₂O₃ co-doped glass. Comparison of up-conversion and down-conversion luminescence spectra of bulk glass, glass fibre and different length double-clad optical fibre (up to 5 m) showed subtle differences in shape of the spectrum. In comparison to down – conversion emission (λ_{exc} = 405 nm) main UC luminescence band is red-shifted by 2 nm and is characterized by 5 nm greater full – width half – maximum (FWHM).