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Enhanced near/mid-infrared emission bands centered at ~1.54 and ~2.73 μm of Er^{3+}-doped in transparent silicate glass-ceramics via Mn^{2+}-Yb^{3+} dimer

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Abstract

The near/mid-infrared emission of Er^{3+}-doped, Er^{3+}-Yb^{3+} co-doped and Er^{3+}-Mn^{2+}-Yb^{3+} tri-doped in $40SiO_2$–$(22.9-x)Al_2O_3$–$20BaF_2$–$10LaF_3$–$5TiO_2$– $xMnO$–$0.1Er_2O_3$–$2Yb_2O_3$ (in mol. %, x = 0, 2.0, 4.0, 6.0 and 10.0) (acronym: SGC-xMn) transparent silicate glass-ceramics were prepared. Enhanced near/mid-infrared emission intensity of Er^{3+}-doped bands centered at ~1.54 and ~2.73 μm in transparent silicate glass-ceramics via Mn^{2+}–Yb^{3+} dimer under 980 nm excitation were investigated. XRD results indicate that the Mn^{2+} ions are dispersed into the glass matrix. With the forming of Mn^{2+}–Yb^{3+} dimer and the energy transfer processes from Mn^{2+}–Yb^{3+} dimer and Mn^{2+} to Er^{3+} ions has led to NIR emission intensity of Er^{3+}-doped at ~1.54 μm was increased significantly about four-fold and the MIR emission intensity of Er^{3+}-doped at ~2.73 μm was increased about third-fold. In addition, based on the decay time spectra, mechanism of energy transfer processes between Mn^{2+}–Yb^{3+} dimer, Mn^{2+} and Er^{3+} ions were also discussed.

Keywords: Near-infrared; Mid-infrared; 1.54 μm; 2.73 μm; Mn^{2+}–Yb^{3+} dimer;

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