

Gd<sup>3+</sup> doping induced enhanced upconversion luminescence in Er<sup>3+</sup>/Yb<sup>3+</sup> co-doped transparent oxyfluoride glass ceramics containing NaYF<sub>4</sub> nanocrystals

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nanocrystals

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## Abstract

In this article, transparent oxyfluoride glass ceramics containing  $\beta$ -NaYF<sub>4</sub> nanocrystals were successfully prepared via Gd<sup>3+</sup> doping. Compared to conventional non-doped glasses, the thermal treatment temperature required for the precipitation of  $\beta$ -NaYF<sub>4</sub> nanocrystals can be lowered with the doping of Gd<sup>3+</sup>. Furthermore, under the same thermal treatment condition, more  $\beta$ -NaYF<sub>4</sub> nanocrystals were precipitated in Gd<sup>3+</sup> doped ones, which greatly improves the luminescence efficiency of rare earth doped glass ceramics. Possible mechanism for the Gd<sup>3+</sup> doping induced enhanced upconversion luminescence phenomenon was proposed, based on thorough structural and optical characterizations. The results revealed that the doping of Gd<sup>3+</sup> ions could

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