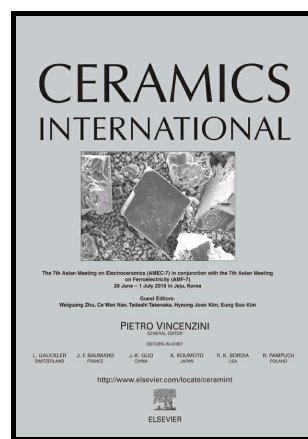


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Enhanced upconverted luminescence and the optical thermometry behavior of Er^{3+} -doped BaYbF_5 transparent glass ceramics

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ABSTRACT

Transparent SiO_2 - Al_2O_3 - Na_2O - CaO - BaF_2 - YbF_3 glass ceramics (GC) doped with Er^{3+} ions were successfully fabricated by a melt-quenching technique with subsequent heat treatment. The formation of BaYbF_5 nano-crystalline phase was confirmed by X-ray diffraction and transmission electron microscopy. Compared to the precursor glass (PG), the clearer Stark splitting and greatly enhanced up-conversion (UC) emission in GC indicate that Er^{3+} ions mainly enter into BaYbF_5 nanocrystals with low phonon energy after crystallization. The temperature dependent on purple UC emission ratio (which is due to the $\text{Er}^{3+} {}^4\text{G}_{11/2} \rightarrow {}^4\text{I}_{15/2}$ and ${}^2\text{H}_{9/2} \rightarrow {}^4\text{I}_{15/2}$ transitions) and common green UC emission ratio with low-power excitation in BaYbF_5 GC have been studied respectively. In addition, the UC mechanisms in PG and GC are illustrated and analyzed. The outstanding properties of Er^{3+} -doped BaYbF_5 transparent GC may present potential applications in all-solid-state UC lasers and optical fiber temperature sensors.

Keywords: Glass ceramics; BaYbF_5 ; Er^{3+} ; Up-conversion; Optical thermometry.

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