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Photon avalanche upconversion in Ho³⁺-Yb³⁺ co-doped transparent oxyfluoride glass-ceramics

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Abstract

The Ho³⁺-Yb³⁺ co-doped transparent glass and glass-ceramics containing CaF₂ nanocrystals have been prepared. Differential thermal analysis and X-ray diffraction measurements have been made to characterize thermal properties of glass and structural changes in glass-ceramics, respectively. Photon avalanche upconversion has been achieved by exciting the samples at 745 nm at room temperature. An intense green and a weak red upconverted emissions corresponding to the ⁵S₂:⁵F₄→⁵I₈ and ⁵F₅→⁵I₈ transitions, respectively, have been observed. The upconversion intensity has been found to increase with the increase in the size of the fluoride nanocrystals in glass-ceramics. Experimental evidences confirm that the mechanism of upconversion is photon avalanche.

Keywords: Oxyfluoride glasses; Glass-ceramics; Ho³⁺ and Yb³⁺ ions; Upconversion; Photon avalanche.

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