Synthesis, morphology and spectroscopy of cubic Y_3NbO_7:Er.

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Streszczenie

Synthesis of Y_3NbO_7:Er powders with the aid of Li_2SO_4 flux is reported and spectroscopic properties of the resultant powders are presented. The dopant content varied in the range of 0.1–15 at%. The materials crystallized in the fluorite-type cubic structure in which all the metal ions—Y, Nb, and Er—randomly occupy the same site offered by the host lattice and the O-vacancy is also randomly distributed within the metal surrounding. Transmission electron microscopy images revealed that the agglomeration of particles is very low and the sizes of the grains are around 500 nm. Selected area electron diffraction patterns proved that each grain is monocrystalline. Absorption, excitation, and emission spectra are characterized by relatively broad structures related to the Er^{3+} ion. The broadening results from some inhomogeneity of the activator ion surroundings related to the specific structure of the host lattice. When the Er content is only 0.1% both photoluminescence and up-converted emission are dominated by a green luminescent band around 550 nm. However, the efficiency of up-conversion is very low . With increasing concentration of the dopant, a red band located around 665 nm appears and becomes systematically stronger. In up-converted emission, the intensity of the red band surpasses the green one when the Er concentration exceeds 5%. For low concentrations, the up-conversion occurs through a sequential absorption of two infrared (IR) (980 nm) photons from the excitation beam by Er^{3+} ion through excited-state absorption mechanism. For higher concentrations, the energy transfer between two neighboring excited Er ions plays dominant role. Surprisingly, the mechanism of up-converted low-intensity luminescence from $^2H_{11/2}$ state seems to diverge from the mechanism characteristic for the $^4S_{3/2}$ level, which conclusion comes from different slopes of the double-log relationships.

Słowa kluczowe

Niobates, Erbium, Luminescence, Up-conversion

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