PREPARATION AND INVESTIGATION OF Er^{3+}/Yb^{3+} CO-DOPED $La_2Zr_2O_7$ CERAMIC

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Nowadays, much attention is paid to the investigation of compounds $Re_2Zr_2O_7$ with the pyrochlore structure, where "Re" corresponds to La, Ce, Gd, Sm, Nd etc. Such materials are employed in a variety of different applications due to their interesting optical, electrical, magnetic and catalytic properties. A number of different dopants have been studied to obtain visible emissions under IR-excitation. Erbium and ytterbium are one of possible dopants and used to achieve up-conversion luminescence. Lanthanum zirconate ceramics with the pyrochlore structure codoped Er^{3+}/Yb^{3+} are prospective media for efficient up-conversion. For the preparation of such ceramics solvo-chemical synthesis was used. Lanthanide nitrate and zirconyl nitrate hydrates were dissolved in distilled water with small amount of nitric acid. Obtained clear solution was drop by drop added to the ammonium hydroxide. The pH of the resulting solution was adjusted to about 7.5–8 and gel-like precipitates were dried at 80 °C. Dried powders were calcined at 400°C in air atmosphere for 4h. The powders were pressed into discs of about 9 mm diameter and 1 mm thickness and fired at 1500 °C with annealing period lasting 2 h. XRD data (Fig.1) indicate the formation of the $La_2Zr_2O_7$ phase with a pyrochlore structure. The doping with doped Er^{3+}/Yb^{3+} resulted in slightly deviated pyrochlore unit cell parameters. However, addition of yttrium and erbium can also leads to a structural transformation from the ordered to the disordered pyrochlore structure. The up-conversion luminescence spectra of the Er^{3+}/Yb^{3+}co-doped ceramic using 980 nm excitation are shown in Fig. 2. The emission in the green region centered at 525 and 545 nm are related to the $^2H_{11/2}$ and the $^4S_{3/2}$ excited states transitions of the Er^{3+} ions. The band corresponding to the red emission over the 620–680 nm range is related to the $^4F_{9/2} \rightarrow {}^4I_{15/2}$ transitions.

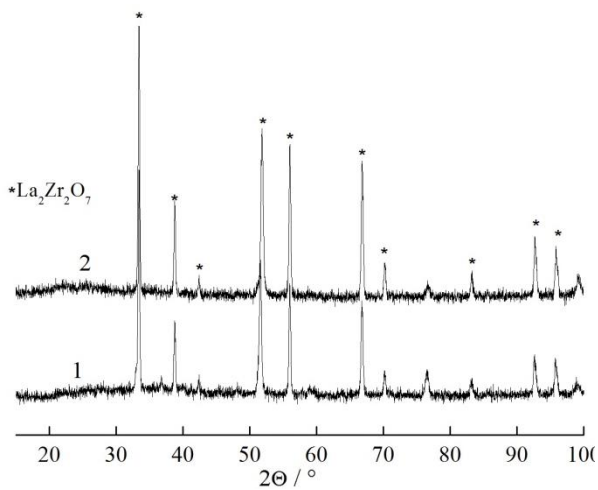

Fig. 1. XRD patterns of $La_2Zr_2O_7$ ceramics without dopants (1) and Er^{3+}/Yb^{3+} co-doped (2)

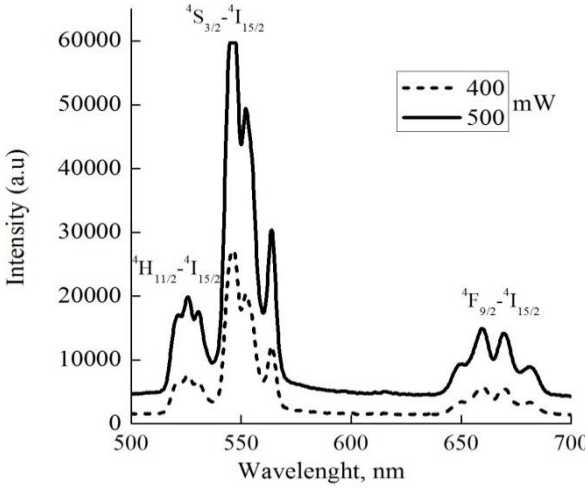

Fig. 2. The up-conversion luminescence spectra of the Er^{3+}/Yb^{3+}co-doped ceramic

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