NANOCRYSTALLINE EUROPIUM-YTTRIUM TITANATES $(EU_XY_{1-X})2TI_2O_7$ PHOSPHORS FOR FIBER-LASERS

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Abstract

Nanocrystalline rare-earth doped yttrium titanates, which crystallize in a pyrochlore structure with general formula $(RE_xY_{1-x})2Ti_2O_7$ (RE=rare-earth element), have been widely investigated in recent years for their interesting luminescence properties. Comparing to the yttrium-free rare-earth titanates with the general formula $RE_2Ti_2O_7$, which are mainly optically inactive, the presence of yttrium ions in the pyrochlore structure enormously improves the luminescence properties of contained rare earth elements. In this contribution we present versatile sol-gel route to nanocrystalline $(Eu_xY_{1-x})2Ti_2O_7$ pyrochlores. The concentrations of europium ions in prepared compounds were varied up to x=0.4. Prepared sols were evaporated to amorphous powders that were thermally treated forming nanocrystalline powders. The morphology and the structure of formed nanocrystals were linked to the luminescence properties of Eu_{3+} ions incorporated inside the pyrochlore lattice. The presented approach leads to the formation of homogenous nanocrystalline $(Eu_xY_{1-x})2Ti_2O_7$ powders and thin films with tailored grain sizes ranging from 10 nm to 200 nm. The results of XRD and HRTEM analysis show that the Eu_{3+} and Y_{3+} ions are regularly distributed inside the lattice. Optimal concentration of Eu_{3+} ions in the structure is around x=0.03 providing the radiative lifetime of red emission in the range of several milliseconds.The results present fundamental information about the effect of the size of the nanocrystals to their luminescence properties. The promising application of prepared nanocrystals in the field of lasers and planar optical amplifiers is widely discussed in the contribution.

Keywords: Europium, luminescence, nanocrystals, sol-gel

ACKNOWLEDGEMENTS

This work was supported by the Czech Science Foundation, contract No 102/13/37368P.

Author did not supply full text of the paper/poster.