OPTICAL PROPERTIES OF NANOCRYSTALLINE EUROPIUM PYROCHLORIDE EU2TI2O7

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Abstract
Lanthanide titanium oxides, which crystallize in a pyrochlore structure with general formula RE2Ti2O7 (RE=rare earth element), have been extensively investigated in recent years for their interesting physical and chemical properties. According to theoretical predictions the pyrochlores exhibit exciting magnetic properties. Despite the poor luminescence ability of the pyrochlore structure they also find their place in the field of optical materials. However, the luminescence properties of pyrochlores strongly depend on the size of formed nanocrystals.

In this contribution we present a versatile sol-gel synthesis of nanocrystalline Eu2Ti2O7 pyrochlore. The nanocrystalline powders were prepared by the condensation of titanium(IV)butoxide with europium(III) chloride followed by the calcination. The morphology and the structure of the formed nanocrystals are linked to the luminescence properties of Eu3+ ions incorporated into the pyrochlore lattice.

The introduced method leads to the formation of the highly-homogenous nanocrystalline Eu2Ti2O7 with tailored grain size ranging from 20 nm to 100 nm. The lifetime of Eu3+ ions in calcinated powders is regularly decreasing from 140 us to 12 us according to the calcinations temperature. The shape of the luminescence spectra and the decrease of the lifetime correspond with the crystallinity of prepared powders. 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 optical amplifiers is widely discussed in the contribution.

Keywords: luminescence, europium, nanocrystals, sol-gel

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