Physico-Chemical nanomaterials science

Synthesis, structure and luminescence properties of ZrO_2 nanoparticles doped with fluorine and europium

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During the last several decades zirconium oxide (zirconia) has been intensively studied as a material for superionic conductors, biomarkers, oxygen sensors, luminophores, catalysts, solid electrolyte for fuel cells. Both experimental and theoretical studies were performed in order to establish peculiarities of the crystal structure, physical properties and electronic band structure of different polymorphs of ZrO_2. However, the improvement of physical properties of zirconia by changes in its crystal lattice (e.g. by doping) still an actual problem of material science. The substitution in anionic sublattice is one of the ways to improve the properties of the crystals. It was shown earlier the increase of nitrogen content in the ZrO_2:Eu,N systems leads to stabilization of cubic ZrO_2 and to enhance of the Eu^{3+} luminescence intensity [1]. In the same time the fluorine ions introduced into ZrO_2 host due to high dopant concentration led to formation of the row of zirconium oxyfluorides [2]. There is no papers deal with structure and properties of nanoparticles of ZrO_2 doped with low amount of fluorine. Importantly, the information about symmetry of the sites occupied by Eu^{3+} ions can be obtained from luminescence spectra. Therefore, $ZrO_{2-x}F_{2x}$:Eu systems provide a good opportunity for studying of fluorine influence on crystal structure of oxide compounds.

In this work both undoped and Eu^{3+}-doped the $ZrO_{2-x}F_{2x}$ ($x = 0.01 – 0.05$) nanoparticles were synthesized by solid state method and their structure, morphology and photoluminescence properties were studied for the first time.

The influence of fluorine on luminescence properties of ZrO_2 and ZrO_2:Eu crystals analyzed and discussed.

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