Quenching of the Eu^{3+} luminescence by Cu^{2+} ions in the nanosized hydroxyapatite designed for future bio-detection.

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Streszczenie

The hydroxyapatite nanopowders of the Eu^{3+}-doped, Cu^{2+}-doped, and Eu^{3+}/Cu^{2+}-co-doped $Ca_{10}(PO_4)_6(OH)_2$ were prepared by a microwave-assisted hydrothermal method. The structural and morphological properties of the products were investigated by X-ray powder diffraction (XRD), transmission electron microscopy techniques (TEM), and infrared spectroscopy (FT-IR). The average crystal size and the unit cell parameters were calculated by a Rietveld refinement tool. The absorption, emission excitation, emission, and luminescence decay time were recorded and studied in detail. The $^5D_0 \rightarrow {}^7F_2$ transition is the most intense transition. The Eu^{3+} ions occupied two independent crystallographic sites in these materials exhibited in emission spectra: one Ca(1) site with C_3 symmetry and one Ca(2) sites with C_s symmetry. The Eu^{3+} emission is strongly quenched by Cu^{2+} ions, and the luminescence decay time is much shorter in the case of Eu^{3+}/Cu^{2+} co-doped materials than in Eu^{3+}-doped materials. The luminescence quenching mechanism as well as the schematic energy level diagram showing the Eu^{3+} emission quenching mechanism using Cu^{2+} ions are proposed. The electron paramagnetic resonance (EPR) technique revealed the existence of at least two different coordination environments for copper(II) ion.

Słowa kluczowe

apatite, europium ions, cooper ions, photoluminescence spectroscopy, EPR spectroscopy

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