

Structural and optical properties of Vernier phase lutetium oxyfluorides doped with lanthanide ions: interesting candidates as scintillators and X-ray phosphors.

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Streszczenie

Undoped, Ce^{3+} , Pr^{3+} and Eu^{3+} doped lutetium oxyfluoride submicrometre powders have been prepared by a simple coprecipitation procedure in water. The synthesized samples are Vernier single phases with a stoichiometry assigned to $\text{Lu}_{10}\text{O}_9\text{F}_{12}$, as demonstrated by X-ray powder diffraction. The structural disorder of the host matrix significantly affects the optical emission spectra of the lanthanide doped samples as well as their vibrational spectra. The observed bandwidths of the FTIR spectrum and Raman scattering of the undoped sample are consistent with a very disordered nature of the host. From an analysis of the emission spectra of the Eu^{3+} doped sample it was found that different sites accommodating the lanthanide ions are present in the crystal structure. The Pr^{3+} and Ce^{3+} doped oxyfluoride samples show radioluminescence emission both in the UV and visible regions. The UV emission is due to lanthanide 4d–5f transitions, differently from the behavior observed for Ce^{3+} and Pr^{3+} doped Lu_2O_3 , showing no UV emission. Considering the high mass density (close to 9 g cm^{-3}), and the suitable location of rare earth ion electronic levels in the material band gap, as demonstrated by the observation of radiative emissions for all activators, the materials under investigation can be considered interesting candidates for scintillator or phosphor materials in the UV and visible regions.

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