Combining XRD and SEM techniques with site selective spectroscopy for structural and spectroscopic studies of Nd^{3+}-doped $LuPO_4$ micro-powders.

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We present and discuss the structural and spectroscopic properties of micro-crystalline Nd^{3+}-doped $LuPO_4$ zircon-(xenotime)-type orthophosphates (0.5–20 mol% of Nd^{3+} ions) synthesized by high-temperature solid-state reaction, in which Nd^{3+} optical rare earth ion plays the role of a structural probe. Surprisingly, in the literature there are not many studies performed for this optical material. The basic structural research with detailed information about the non-equivalent symmetry sites for the powdered samples with different Nd^{3+} ion concentrations is still missing. It is very important to fulfill this gap in order to properly apply this optical material. A series of Nd^{3+}-doped $LuPO_4$ micro-powders were obtained by using molar ratio of Lu_2O_3, Nd_2O_3, and $NH_4H_2PO_4$ as the starting materials. Also, for some samples the 10% of ammonium dihydrogen phosphate excess was applied. The XRD and SEM analysis reveal some dependence of Nd^{3+} ion concentration and synthesis route on the crystal structure. The low-temperature high-resolution techniques like absorption spectroscopy at 4.2 K and site-selective tuneable laser spectroscopy at 77 K allowed to take advantage of Nd^{3+} ion as a probe for local ordering due to the close relation between its spectroscopic properties and the local structure at the ion site. To the best of our knowledge such a study has not been reported for micro-powdered Nd^{3+}-doped $LuPO_4$.

Słowa kluczowe

Lutetium orthophosphates, Nd3+ ions, Micro-powders, NIR emitting optical materials, Nd3+ symmetry site

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