

Effect of silica-alumina co-introduction on structure as well as physical and spectroscopic properties of Nd³⁺-doped potassium phosphate glass

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The effect of silica-alumina co-introduction on physical and spectroscopic properties of Nd³⁺-doped potassium phosphate glass was investigated. The Raman and X-ray photoelectron spectroscopy (XPS), physical parameters as well as spectroscopic characteristics were determined and analyzed in detail. Q² units gradually increase while Q¹ units have the opposite trend with the increase of SiO₂/Al₂O₃ ratios. Meanwhile the total number of [AlO₆] octahedrons and [AlO₄] tetrahedrons continue to decrease with [AlO₆]/ [AlO₆]+ [AlO₄] ratio keeping rise. As a result, the increase of more symmetrical bridge oxygen bonds and more ionic Si-O bonds lead to more centrosymmetric and stronger ionicity of Nd³⁺ ion coordination environment. The physical and spectroscopic properties of glasses benefit from silica-alumina co-introduction. When SiO₂/Al₂O₃ ratio was 1.8, the glass showed a high emission cross-section of 3.05 × 10⁻²⁰ cm², a high optical gain parameter of 10.8 × 10⁻²⁴ cm²s, together with wider gain bandwidth parameter of 7.61 × 10⁻²⁶ cm³.

Słowa kluczowe

Potassium phosphate glass, Silica-alumina co-introduction, Raman spectra, XPS, Spectroscopic properties

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