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Structural and spectroscopic properties of $\text{MgAl}_2\text{O}_4\text{:Nd}^{3+}$ transparent ceramics fabricated by using two-step Spark Plasma Sintering

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Abstract:

Neodymium-doped magnesium aluminate spinel $\text{Nd}^{3+}\text{:MgAl}_2\text{O}_4$ transparent ceramics were successfully elaborated **with significant Nd content (i.e. up to 0.2at.%)** by using Spark Plasma Sintering (SPS). Microstructural, structural, and optical properties of the obtained samples were compared to those of undoped transparent spinel ceramics. The transparency is of about 70% in the visible region for undoped samples and of about 50% for neodymium-doped samples with a significant shift of the cut-off wavelength in UV region to higher values. Spectroscopic measurements have evidenced the formation of charge-compensating structural defects owing to Mg^{2+} substitution by Nd^{3+} in the spinel crystalline lattice. Nd^{3+} ions were incorporated up to 0.2at.% in spinel crystalline lattice, largely higher than that possible in MgAl_2O_4 single-crystals. SPS thus appears as an appropriate technique to manufacture transparent materials with out-of-equilibrium structure and composition.

Keywords: Neodymium, spinel, transparent ceramics, SPS, spectroscopy

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