

# SYNTHESIS AND LUMINESCENT CHARACTERIZATION OF DOPED

## $\text{Na}_{1-x}\text{AlGe}_{1-0.5x}\text{O}_4\text{:X}$ PHOSPHORS

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The demand for energy-efficient lighting has spurred research into luminescent materials, crucial for the development of next-generation technologies. As white light-emitting diodes (LEDs) gain prominence for their efficiency, long life, and minimal energy consumption, there's a growing need to explore novel luminescent materials. Recently, increasing attention has been paid to germanate compounds, which are suitable for the development of phosphors due to their low synthesis temperature and excellent physicochemical properties.

Sodium aluminum germanate  $\text{NaAlGeO}_4$  has a monoclinic structure with the symmetry space group  $P2_1/n$ . The lattice parameters of  $\text{NaAlGeO}_4$  are  $a = 8.783 \text{ \AA}$ ,  $b = 15.432 \text{ \AA}$ ,  $c = 8.252 \text{ \AA}$ , and the lattice angles  $\alpha = 90.00^\circ$ ,  $\beta = 90.00^\circ$ ,  $\gamma = 90.09^\circ$ .  $\text{NaAlGeO}_4$  is characterized by unique optical and electronic properties, including high thermal stability, strong photoluminescence, and high transparency in the visible and near-infrared range. Furthermore, its composition and crystal structure render it well-suited for diverse applications, including serving as a host material for rare earth ions in solid-state lighting and functioning as a dielectric material for capacitors.

During this study, a sequence of  $\text{Na}_{1-x}\text{AlGe}_{1-0.5x}\text{O}_4\text{:X}$  samples doped with varying concentrations of  $\text{Bi}^{3+}$ ,  $\text{Ce}^{3+}$ ,  $\text{Dy}^{3+}$ ,  $\text{Eu}^{3+}$ ,  $\text{Pr}^{3+}$ ,  $\text{Sm}^{3+}$  and  $\text{Tb}^{3+}$  ions were synthesized using the solid-state synthesis method. The obtained samples underwent characterization through the powder X-ray diffraction (XRD) technique and photoluminescence (PL) measurements, including excitation and emission spectra, luminescence decay times, and quantum efficiencies. The XRD analysis demonstrated that all samples exclusively consisted of the pure  $\text{NaAlGeO}_4$  phase. Insights from the PL measurements revealed specific emission characteristics for each ion: red emission in  $\text{Eu}^{3+}$ -doped samples, yellow emission in  $\text{Dy}^{3+}$ -doped samples, blue emission in  $\text{Bi}^{3+}$  and  $\text{Ce}^{3+}$ -doped samples, orange-red emission from  $\text{Pr}^{3+}$ , orange emission from  $\text{Sm}^{3+}$ , and green emission from  $\text{Tb}^{3+}$ .

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