

# Synthesis, Characterization, EPR, Photo And Thermoluminescence Properties Of $\text{YAlO}_3:\text{Ni}^{2+}$ Nanophosphors

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## Abstract:

$\text{YAlO}_3:\text{Ni}^{2+}$  (0.1 mol%) doped nanophosphor was synthesised by a low temperature solution combustion method. Powder X-ray diffraction (PXRD) confirms the orthorhombic phase of yttrium aluminate ( $\text{YAlO}_3$ ) along with traces of  $\text{Y}_3\text{Al}_5\text{O}_{12}$ . Scanning Electron microscopy (SEM) shows that the powder particles appears to be spherical in shape with large agglomeration. The average crystallite sizes appeared to be in the range 45–90 nm and the same was confirmed by transmission electron microscopy (TEM) and Williamson–Hall (W–H) plots. Electron Paramagnetic Resonance (EPR) and photoluminescence (PL) studies reveal that  $\text{Ni}^{2+}$  ions are in octahedral coordination. Thermoluminescence (TL) glow curve consists of two peaks with the main peak at  $\sim 224^\circ\text{C}$  and a shouldered peak at  $285^\circ\text{C}$  was recorded in the range 0.2–15 kGy  $\gamma$ -irradiated samples. The TL intensity was found to be increasing linearly for  $224^\circ\text{C}$  and  $285^\circ\text{C}$  peaks up to 1 kGy and thereafter it shows sub-linear (up to 8 kGy) and saturation behavior. The trap parameters namely activation energy ( $E$ ), order of kinetics ( $b$ ), frequency factor ( $s$ ) at different  $\gamma$ -doses were determined using Chens glow peak shape and Luschi's methods then the results are discussed in detail. Simple glow peak structure, the  $224^\circ\text{C}$  peak in  $\text{YAlO}_3:\text{Ni}^{2+}$  nanophosphor can be used in personal dosimetry.

## Keywords:

Phosphor

X-ray diffraction

$\text{YAlO}_3$

$\text{Ni}^{2+}$

EPR

Thermoluminescence