Synthesis, EPR and Luminescent Properties of $YaIo_3:Fe^{3+}$ (0.1–0.9 Mol%) Nanopowders

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Abstract

A simple and inexpensive combustion method was used to prepare Fe^{3+} doped $YAlO_3$perovskite within few minutes at low temperature (400 ± 10 °C). This might be useful in lowering the cost of the material. The final products were well characterized by various spectroscopic techniques such as PXRD, SEM, TEM, FTIR and UV–Visible. The average crystallite size was estimated from the broadening of the PXRD peaks and found to be in the range 45–90 nm, the results were in good agreement with the W–H plots and TEM. The crystallites show dumbbell shape, agglomerated particles with different size. The TL glow curves of 1–5 kGy γ-irradiated $YAlO_3:Fe^{3+}$ (0.1 mol%) nanopowder warmed at a heating rate of 3 °C s^{-1} records a single glow peak at ~260 °C. The kinetic parameters namely activation energy (*E*), order of kinetics (*b*) and frequency factor (*s*) were determined at different gamma doses using the Chens glow peak shape method and the results were discussed in detail. The photoluminescence spectra for Fe^{3+} (0.1–0.9 mol%) doped $YAlO_3$ records the lower energy band at 720 nm ($^4T_1$ (4G) → $^6A_1$ (6S)) and the intermediate band located at 620 nm ($^4T_2$ (^4G) → $^6A_1$ (6S)) with the excitation of 378 nm. The higher energy band located at 514 nm was associated to ^4E + $^4A_1$ (^4G) → $^6A_1$ (6S) transition. The resonance signals at *g*values 7.6, 4.97, 4.10, 2.94, 2.33 and 1.98 were observed in EPR spectra of Fe^{3+} (0.1–0.9 mol%) doped $YAlO_3$ recorded at room temperature. The *g* values indicate that the iron ions were in trivalent state and distorted octahedral site symmetry was observed.

Keywords

Phosphor

Photoluminescence

Optical absorption

Combustion synthesis