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Effect of synthesis methods on luminescence properties of LiCaPO₄:Ce phosphor for radiation dosimetry

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Abstract

The polycrystalline doped and un-doped LiCaPO₄ phosphors were successfully prepared via solid state diffusion [SSD] and sol-gel [SG] methods. The sol-gel method was implied to decrease the processing time and heating temperature. The prepared un-doped and doped LiCaPO₄ phosphors were characterized through X-ray diffraction (XRD) and scanning electron microscopy (SEM) techniques. Additionally photoluminescence (PL), thermoluminescence (TL) and optically stimulated luminescence (OSL) properties were studied. The XRD patterns of prepared LiCaPO₄ and LiCaPO₄:Ce phosphors were well matched with the ICDD file. The average particles size of LiCaPO₄ and LiCaPO₄:Ce phosphors were found to be in the range 2-10 μm by SSD method and 2-5 μm by SG method. The excitation spectra of LiCaPO₄ and LiCaPO₄:Ce phosphors consist of broad band in the range 200-330 nm and maximum intensity was observed at 314 nm. Also emission spectra consist of broad band in range from 330-500 nm and maximum intensity was observed at 369 nm. With the increase of Ce³⁺ ions concentration, the emission spectra of LiCaPO₄:Ce³⁺ phosphors shifted to a longer wavelength. The prepared phosphors were showed excellent TL properties under β irradiation. The OSL sensitivity of the

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