

Synthesis and Thermoluminescence Study of Nanocrystalline Radiation Dosimeter $\text{CaSO}_4:\text{Ce}/\text{Sm}/\text{Dy}$

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Abstract : This paper reports the thermoluminescence (TL) properties of nanocrystalline CaSO_4 activated by Ce, Sm, and Dy. TL properties are investigated by chiefly changing the dopant element and also by varying the concentration of the dopant elements (from 0.05 mol % to 0.5 mol %) so as to establish the optimized dopant concentration for each of the activators. The method of salt preparation used is the typical chemical co-precipitation method and the technique used for characterization of the prepared samples is the X-Ray Diffraction (XRD) technique. Further, the phosphors are irradiated with gamma radiation from Co-60 (1.25 MeV) source (dose range- 30 Gy to 500 Gy). The optimized concentration (vis-a-vis TL peak intensity) of activator for $\text{CaSO}_4:\text{Ce}$ is found to be 0.2 mol %, for $\text{CaSO}_4:\text{Sm}$ it is 0.1 mol % and for $\text{CaSO}_4:\text{Dy}$ it is 0.2 mol %. Further, the primary study of the TL response curves for all the three phosphors confirms linearity in the studied dose range (i.e., 30 Gy to 500 Gy). Finally, $\text{CaSO}_4:\text{Dy}$ was also studied for its energy dependence property which plays an important role in defining the utility of a phosphor for dosimetric applications. The range of doses used for the energy dependence study was from 30 Gy to 500 Gy from Cs-137 (0.662 MeV). The nano-phosphors showed potential to be used as radiation dosimeter in the studied range of gamma radiation and thus must be studied for a wider range of doses.

Keywords : gamma radiation, nanocrystalline, radiation dosimetry, thermoluminescence

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