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Synthesis and Characterization of Dy- and Ce-Co-Doped Lithium Calcium Silicate

Thermoluminescence (TL) is the light emitted by certain crystals when heated after being irradiated, and it is used to measure radiation doses. A good dosimeter must be sensitive, linear, stable over time, and reproducible—properties that depend on the point defects created during synthesis. Electron paramagnetic resonance (EPR) allows for the identification of paramagnetic defects that appear after irradiation and that could give rise to TL emission, thereby helping to understand its mechanisms. In this work, we studied the TL properties of calcium lithium silicate (Li_2CaSiO_4) co-doped with Ce and Dy, synthesized using the solid-state reaction technique. The structure of the synthesized samples was analyzed by X-ray diffraction (XRD). The samples containing 0.5 molar % Ce and 0.3 molar % Dy exhibited the highest TL sensitivity, with luminescence curves showing two peaks at 150 and 240 °C. Using Tm-Tstop and deconvolution techniques, the kinetic parameters associated with the TL peaks of the Dy,Ce-doped Li_2CaSiO_4 were determined. Gamma irradiation of the phosphor generates several defect centers, which are analyzed using EPR to identify them and explore their relationship to the TL processes in the phosphor. The spectrum reveals contributions from at least three defect centers.

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