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ISOTHERMAL DECAY ANALYSIS OF INTERMEDIATE TL PEAKS OF NANO-A-ALUMINA

This work is a continuation of a thermoluminescence (TL) study of the behaviour of nano α-Al2O3 (40 nm) in the temperature range of 110 to 160℃ to elucidate the kinetic mechanisms driving its TL response [1–4]. The isothermal decay curves were analyzed to determine the order of kinetics and activation energies of the TL peaks. The ln(I) vs. time plot revealed a nonlinearity starting at 140℃, indicating that the TL peaks do not follow first-order kinetics in this temperature region. Subsequent analysis confirmed that the TL data align with second-order kinetics, with a kinetic-order parameter of b = 2.0 providing the best linear fit.
Further examination of the ln(slope) vs. 1/kT relationship revealed a composite structure in the TL response, characterized by three distinct linear sections. These sections correspond to activation energies of 0.6±0.12 eV, 1.07±0.25 eV, and 1.61±0.47 eV, respectively, suggesting the presence of three different centers contributing to the dosimetric peak. To address the above behavior for nano-sized alumina, the main dosimetric peak was also deconvoluted into three peaks applying the Computerized Glow Curve Deconvolution (CGCD) procedure using GlowFit program (Fig. 1). The maximum temperatures of the three component glow peaks were found to be 425, 472 and 503 K. Correspondingly, the activation energies for these peaks were found to be 0.68 eV, 1.01 eV and 0.85 eV, while the corresponding frequency factors were calculated to be 5.10x106, 3.45x1010 and 1.29x108 s-1.

Section

Nuclear physics (Section 1)

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