

Thermoluminescent Response of Nanocrystalline BaSO₄:Eu to 85 MeV Carbon Beams

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Abstract : Nanotechnology and nanomaterials have attracted researchers from different fields, especially from the field of luminescence. Recent studies on various luminescent nanomaterials have shown their relevance in dosimetry of ionizing radiations for the measurements of high doses using the Thermoluminescence (TL) technique, where the conventional microcrystalline phosphors saturate. Ion beams have been used for diagnostic and therapeutic purposes due to their favorable profile of dose deposition at the end of the range known as the Bragg peak. While dealing with human beings, doses from these beams need to be measured with great precision and accuracy. Henceforth detailed investigations of suitable thermoluminescent dosimeters (TLD) for dose verification in ion beam irradiation are required. This paper investigates the TL response of nanocrystalline BaSO₄ doped with Eu to 85 MeV carbon beam. The synthesis was done using Co-precipitation technique by mixing Barium chloride and ammonium sulphate solutions. To investigate the crystallinity and particle size, analytical techniques such as X-ray diffraction (XRD) and Transmission electron microscopy (TEM) were used which revealed the average particle sizes to 45 nm with orthorhombic structure. Samples in pellet form were irradiated by 85 MeV carbon beam in the fluence range of 1X10¹⁰-5X10¹³. TL glow curves of the irradiated samples show two prominent glow peaks at around 460 K and 495 K. The TL response is linear up to 1X10¹³ fluence after which saturation was observed. The wider linear TL response of nanocrystalline BaSO₄: Eu and low fading make it a superior candidate as a dosimeter to be used for detecting the doses of carbon beam.

Keywords : radiation, dosimetry, carbon ions, thermoluminescence

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