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Synthesis and thermoluminescence kinetic parameters of UV irradiated BaAl2O4:Nd nanocrystals

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Barium aluminate (BaAl2O4) belongs to the spinel group of minerals. The BaAl2O4 exhibits high thermal, chemical stability, hydrophobic behavior, low sintering temperature and high quantum yields. It is a wide-band gap semiconductor, which occurs naturally as the mineral gahnite. Furthermore, BaAl2O4:Nd phosphor material can be used as transparent conductor, scintillators and optical material. Nanocrystalline BaAl2O4 was prepared using the solution combustion synthesis. In this method, urea was employed as a fuel. The crystallite size was found to be 27 nm with a hexagonal structure with the space group P63 as determined by the X-ray diffraction technique. The scanning electron microscopy indicated towards the foamy and fluffy nature of the sample. The diffuse reflectance spectrum of the powder was also recorded. The absorption bands centered at 269 nm was due to the band to band transitions of the host and the bands at 343, 509, 566, 694, 721 and 780 nm were due to the 4f–4f transitions from the Nd3+ ground states to a series of excited states. The corresponding bands were assigned to the transition from 4I9/2 to 4D5/2+4D3/2+2P3/2, 4G7/2, 2G5/2+2G7/2, 4F9/2, 4F7/2+4S3/2, 4F5/2+2H9/2. Thermoluminescence (TL) studies of the BaAl2O4:Nd nanopowders irradiated with UV in the different interval of time0-360 min were recorded at room temperature. A well resolved and prominent TL glow curve with peaks at 332 K and 617 K and a weak peak at 453 K were observed. The TL peaks' (332 K and 453 K) intensities increased with UV exposure up to 266 min and 236 min, respectively and then decreased with a further increase of UV exposure due to the creation of complex defects. The kinetic parameters were obtained from the computerized deconvoluted peaks using various glow curve shape methods.

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