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Characterization of Structural and Optical Properties of CsI:Tl Crystals With Different Precursor Purity

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Cesium iodide doped with Thallium (CsI:Tl) is one of the most materials used for radiation detector applications. In this work, the CsI:Tl crystals that made from the material sources with different precursor purity were investigated by scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDX), X-ray diffraction (XRD), Raman scattering, UV-Vis spectroscopy and photoluminescence (PL). The purpose is to verify effects of precursor purity on structural and optical properties of CsI:Tl crystals. It is expected that type and level of impurities in the precursor is directly related the structural and optical properties. With a modified homemade Bridgman–Stockbarger technique, CsI:Tl samples were grown in two levels of CsI and TlI reactant materials, i.e., having as a very high purity of 99.999 % and a high purity of 99.9 %. XRD showed a good quality of CsI:Tl crystals. It exhibited a cubic structure with a lattice constant of 0.457 nm. From the lower-purity raw materials, the crystal was found in an orange color with a lattice constant of 0.456 nm. CsI:Tl surface morphology by SEM exhibited a smooth surface with some parallel crystal facets. By EDX measurement, elements of C, O, Al and Br were observed for both samples. The total amount of impurity in the sample with a 99.99% purity seems to higher that in the sample with a 99.999% purity. The brighter PL emission was obtained from the orange crystals suggesting impurities. Other details of investigation will be discussed during the presentation.

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