



## **Scintillation characteristics of pure cesium iodide crystals and doped with Tl<sup>+</sup>, Br and Li<sup>+</sup> ions for use as radiation detectors**

**Maria da Conceição Costa Pereira<sup>1</sup>, Tufic Madi Filho<sup>2</sup>, José Roberto Berretta<sup>1</sup>, João Paulo da Silva Alves<sup>1</sup>**

<sup>1</sup> Instituto de Pesquisas Energéticas e Nucleares - IPEN/CNEN, São Paulo, Brazil

<sup>2</sup> Universidade Paulista, São Paulo, Brazil

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In recent years, more attention has been devoted in the discovery of new scintillators or to improve the characteristics of known scintillators. Today inorganic scintillators are exploited in many new fields such as positron emission tomography (PET) computerized X-ray tomography, space physics and astronomy. Inorganic crystals are the scintillators most commonly used for the detection of gamma rays, X-rays and thermal neutrons. CsI:Tl, CsI:Br, CsI:Li and pure CsI crystals were grown in our laboratory using the vertical Bridgman technique. The concentrations of dopants ranged from 10<sup>-1</sup>M to 10<sup>-4</sup>M. The intentional introduction of a certain ion into a crystal depends on physical and chemical properties, that is, the dopant and the matrix. In physical terms, there is a limitation on the volume of ions that can in principle be introduced into the crystal lattice. Furthermore, any substitutional arrangement must preserve the electrical neutrality of the crystal. In chemical terms, one must consider which dopant will accumulate in the phase in which its introduction results in a smaller increase in the free energy of the system. This parameter is represented by the impurity segregation coefficient. It was observed that the wavelength of maximum luminescence emission is characteristic for each crystal. Pure cesium iodide crystal showed maximum intensity of luminescence at the wavelength of 320 nm. The CsI:Tl crystal showed luminescence at a wavelength of 540 nm. CsI:Br and CsI:Li crystals showed maximum luminescence around 420 nm. Analyses were carried out to evaluate the scintillators concerning neutron radiation from AmBe source, with energy range of 1 MeV to 12 MeV. The activity of the AmBe source was 1Ci Am. The fluency was 2.6 x 10<sup>6</sup> neutrons / second. The crystals response gamma radiation was evaluated in the energy range of 355keV to 1333 keV. In this work, the main optical properties of pure and doped CsI with different ions were studied in order to understand the scintillation mechanism and its application in devices that use the principle of scintillation to detect radiation.

**Keywords:** scintillators, crystals, radiation detectors.