Optical properties and radiation response of Li ion-doped CsI scintillator crystal

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Scintillators are materials that convert the energy of ionizing radiation into a flash of light. Due to the existence of different types of scintillators themselves, they were classified into three groups according to their physicochemical characteristics, namely, inorganic, organic and gaseous scintillators. Among the inorganic crystals, the most used as scintillator are constituted of alkali metals, in particular alkaline iodides. Scintillation materials are used in many applications, such as medical imaging, security, physics, biology, non-destructive inspection and medicine. In this work, lithium doped CsI scintillator crystals were grown using the vertical Bridgman technique. The concentration of the lithium doping element (Li) studied was 10^{-4} M to 10^{-1} M. Analyses were carried out to evaluate the scintillators developed concerning to luminescence emission and optical transmittance. The luminescence emission spectra of these crystals were measured with a monochromator for gamma radiation from ^{137}Cs source excitation. The optical transmittance measurements were made in the CsI;Li crystal, in a spectral region of 200 nm to 1100 nm. Determination of the dopant distribution along the crystalline axis, allowing to identify the region with Li concentration uniformity, which is the region of the crystalline volume indicated for use as radiation detector. The crystals were excited with neutron radiation from AmBe source, with energy range of 1 MeV to 12 MeV. As with neutron sources also generate gamma radiation, which can interfere with the measurement, it is necessary that detector be able to discriminate the presence of such radiation. Accordingly, experiments were performed using gamma radiation in the energy range 59 keV to 1333 keV in order to verify the ability of the detector to discriminate the presence of different types of radiation.