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Carrier transportation property of TlBr Gamma-ray detector

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X-ray imaging technology has been applied in medicine, non-destructive testing in industrial sites, and security inspection in airports. Nowadays, semiconductor detectors are widely used as radiation detectors. Since semiconductor detectors convert X-rays directly into electric charges, they are said to have higher spatial resolution than scintillator detectors, which convert X-rays once into visible light.
Ge detectors are widely used as semiconductor detectors in gamma-ray measurements, but their band gap is as narrow as 0.67 eV, which requires cooling with liquid nitrogen, and research on semiconductor detectors that can operate at room temperature is underway.
While detectors using CdTe are widely used as semiconductor detectors that work at room temperature, we focused on thallium bromide (TlBr), which is one of the compound semiconductors. The TlBr detector can be operated at room temperature with a band gap of 2.68 eV, high atomic number (81 for thallium and 35 for bromine), and high density (7.56 g/cm3). Therefore, it is expected to have high detection efficiency at high energy.
Therefore, in this study, as a basic experiment, we performed gamma-ray spectrum measurements using a TlBr detector and a CdTe detector, and showed the radiation detection characteristics of the TlBr detector by measuring the rise time. The TlBr detector showed higher detection efficiency than the CdTe detector at 662 keV gamma rays of 137Cs, but the rise time was longer, which poses a challenge for use at high injection rates.

Topics

Session D. Biomedical optics and sensors technology

Primary author: Mr HIDA, Kosuke (Shizuoka Univ.)

Co-authors: Dr NISHIZAWA, Junichi (Shizuoka Univ.); Dr TABATA, Kento (Shizuoka Univ.); Dr TAKAGI, Katsuyuki (Shizuoka University); Mr OHNO, Amane (Shizuoka Univ.); Prof. AOKI, Toru (Shizuoka University)

Presenter: Mr HIDA, Kosuke (Shizuoka Univ.)

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