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Performance evaluation of newly developed SrI2(Eu) scintillator

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The development of europium-doped strontium iodine (SrI2(Eu)) has attracted considerable attention, because of its excellent material priorities as regards gamma-ray scintillator applications. These include its excellent energy resolution, high light output (˜80,000 ph/MeV), and high effective atomic number (Z = 49). Here we report on the performance of Φ1"× 1"SrI2(Eu) cylindrical crystals newly fabricated by Union Materials Inc. In this study, we measured the energy resolution, light output, and scintillation decay time at 10 degree temperature intervals between -40 and 40℃, using an optically coupled 2-inch photomultiplier tube (PMT) (Super Bialkali, Hamamatsu). The SrI2(Eu) light output increased by 0.68 %/℃ as the temperature decreased. At -20℃, we obtained the optimum energy resolution recording 2.94 ± 0.02% full width at half maximum (FWHM) for 662-keV gamma rays measured with Cs-137. For comparison, we also measured the same crystal using both a large-area (19 × 19 mm2) avalanche photodiode detector (APD) and 8 × 8 multi-pixel photon counter (MPPC) arrays of 3 × 3 mm2 pixels. Optimum energy resolutions of 3.14 ± 0.06% and 3.99 ± 0.01% were obtained with the APD and MPPC, respectively, as measured at -20℃ with a shaping time of 10 (PMT and APD) or 5 μs (MPPC). We also measured the internal background of SrI2(Eu) in a cave composed of Cu-Pb blocks with their thickness of 5—10cm confirming that SrI2(Eu) has an extremely low internal background. In this study, we have shown that SrI2(Eu) is a promising scintillator that can be utilized for radiation measurements incorporating low-energy X-rays to high-energy gamma rays, and can thus be applied in various medical, industrial, and environmental treatment fields in the near future.

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