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Fast scintillation X-ray detector using proportional-mode Si-APD and a HfO2-nanoparticle-doped plastic scintillator

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We have been developing a new fast scintillation detector using proportional-mode Si-APD for synchrotron radiation nuclear forward scattering (NFS) experiments in high-energy X-ray region of >30 keV. We fabricated a prototype detector with a 5wt% lead-loaded plastic scintillator (EJ-256, Eljen Technology) and a proportional-mode Si-APD (S8664-3796(X), Hamamatsu Photonics) as photodetector. The one-channel prototype detector was successfully tested for detection of 67.41 keV X-rays, where the X-ray energy is the same as the γ radiation from Ni-61 (lifetime: 7.6 ns). The prototype detector could measure time spectra with a good time resolution of 0.50 ns by a nanosecond-width outputs. The intrinsic efficiency at 67.41 keV reached 6.9% for a beam path of 3 mm long [1]. We are now fabricating a four-channel detector using four 3×3×3 mmˆ3 EJ-256 scintillators and Si-APD arrays of 3×3 mmˆ2 pixel to increase detection efficiency. The detector has nanosecond response and a beam path of 12 mm long. At the conference, performance of the fast four-channel detector will be shown. We will also give a topic of a 10wt% HfO2-nanoparticle doped plastic scintillator (Hf-PLS), 3 mm in diameter and 1 mm thick. The new scintillator was examined with synchrotron X-ray beam for the prototype detector. Hafnium is one of heavy atoms, which has 72 of atomic number and the *K*-absorption edge of 65.351 keV. Its oxide nanoparticles can be incorporated in a polymer matrix. We previously tested a hafnium-doped organic-inorganic hybrid scintillator fabricated by a sol-gel method [2]. The present scintillator was improved in dispersion of hafnium-oxide particle. The pulse height distribution and time spectra for the prototype detector with Hf-PLS were measured at −34℃ with an increasing APD gain of ˜200 for 57.6 keV X-rays. Light yield of Hf-PLS was 1.2 times as that for EJ-256 of the same size and a good time resolution of 0.34 ns (full width of half maximum) were obtained, which were better than 0.54 ns for EJ-256. This would be due to difference in the scintillation solution, that is only b-PBD was added in Hf-PLS, on the other hand, binary solutions, like PPO and POPOP, were included in EJ-256.

Reference

1. K. Inoue, and S. Kishimoto, Nuclear Instruments and Methods in Physics Research A806 (2016) 420.
2. Y. Sun, M. Koshimizu, N. Yahaba, F. Nishikido, S. Kishimoto, R. Haruki, and K. Asai, Appl. Phys. Lett. 104 (2014) 174104.

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