Applications of Novel Phoswich Detector

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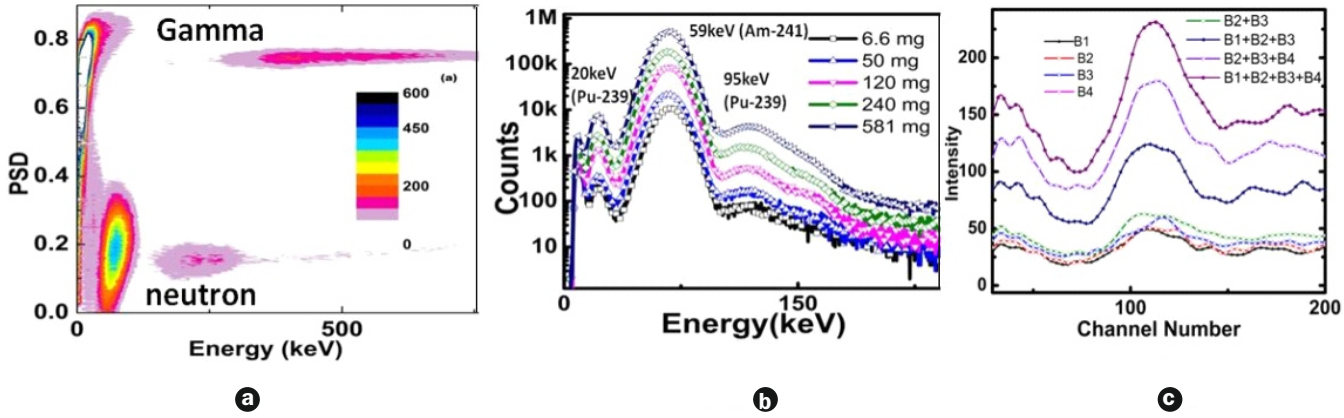
Assaying of SNM Using Simultaneous Detection of Fission Neutrons & Gamma Rays



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(a) Pulse shape discrimination of emitted neutrons and gamma radiation using Phoswich detector.
(b) Measurement of low energy gamma radiation from Pu and Am using Phoswich detector.
(c) Measurement of neutron induced gamma radiation using Phoswich detector.

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Dr. Mohit Tyagi joined Crystal Technology Section, TPD in 2005. Dr. Tyagi visited University of Tennessee as Research Associate, and Kyungpook University as Brainpool Fellow. He specializes in the growth and characterization of scintillators for nuclear radiation detection. He has published about 80 papers, and was responsible for 6 patents. He is a recipient of DAE Young Applied Scientist 2014, IACG Young Crystal Grower 2015, IPS Young Physicist 2016, NASI Young Scientist 2017, DAE S&T Excellence Award 2020. Dr. Tyagi is a Young Associate of Maharashtra Science Academy, Core-committee member of Indian Young Academy of Science, and a member of National Academy of Science.

Non-destructive analysis and measurements of the special nuclear materials (SNM) are necessary for various nuclear industries and safeguard applications. Different techniques, like radiation spectroscopy, mass spectroscopy and chemical chromatography etc., have been used to determine the amounts of various SNM (Pu, Am etc.). However, these techniques have the limitations of source phase, strength, age and mixing quantity etc.

In a recent study (Sonu, Mohit tyagi et al., Nuclear Engineering and Technology, 55, 2023, 2662), we have developed a novel phoswich detector consisting of GGAG (front) and CsI (back) single crystals to detect gamma radiation and neutrons from the standard Pu sources very efficiently. Low energy gamma radiation from Pu or Am can be detected and discriminated from high energies and it shows linearity in a wide range of sample quantities. The high specific activity of Am doesn't introduce dead time in CsI as its radiation at 59keV completely stops in the GGAG which has faster decay time. Thermal neutron detection also shows a very good linearity over wide ranges and the quantity of test sample was also calculated accurately by using the measured calibrated plot.

This novel phoswich detector has the potential to detect gamma and neutrons simultaneously and therefore shows more versatile performance characteristics than any other existing systems.