

Novel scintillator screens for fast neutron detection with improved efficiency and spatial resolution

Tuesday 19 September 2017 10:13 (1 minute)

We report on the comparison of novel scintillator screens for fast neutron detection and neutron imaging with a commercially available screen with respect to efficiency and spatial resolution. The scintillator screens used for the comparison are a 480mm x 480 mm x 2.4 mm sized, 30% ZnS(Cu) loaded into PP matrix developed and produced by RC Tritec AG and other products available on the market.

For the characterization of the two screens fast neutron experiments have been performed at the NEUTRA beam line at the Swiss Spallation Source SINQ. We used a digital detector system based on a cooled CCD camera. For the comparison of both screens we characterized the (i) gamma sensitivity, (ii) the efficiency concerning light output and (iii) the image quality. For the image quality comparison we made radiographic images of a copper step wedge and hexagonal fuel assembly mockup.

We showed that novel ZnS+PP based scintillator is more efficient mainly due to its significantly higher light output. We compared our results with similar ZnS in PP-matrix screen to different plastic scintillators as reported in literature [1]. In [1], at about the same thickness (2.4mm ZnS vs. 3 mm plastic scintillator) the sensitivity of plastic scintillator was found only to be about 10% of that of the RC Tritec AG screen. For a 8 mm thick plastic scintillator in [1], the sensitivity is again only about 38% that of the RC Tritec AG screen.

[1] Guo, J., Bücherl, Zou, Y., Guo, Z., Tang, G. "Comparison of the performance of different converters for neutron radiography and tomography using fission neutrons", Nucl. Inst Meth. A 605, pp 69-72, (2009).

Has accepted

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Session Classification: Poster Session 1

Track Classification: P1_applications