Contribution ID: **53** Type: **Poster**

PVT based Neutron Monitor for Monitoring of Nuclear Smuggling in Cargo Container

Monday, 25 June 2018 16:00 (1 hour)

ABSTRACT

Generally, nuclear material monitoring in container security uses He-3 to measure neutrons generated from nuclear materials. But due to the decrease in the supply of He-3, the development of nuclear material monitors using alternative materials has been performed[1]. Generally, in order to measure neutron, secondary products (electrons, charged particles, and light) which is generated by the reaction of a neutron with a sensor should be measured. Gas-filled proportional counter using a BF3 or 10B thin film has been used to monitor nuclear material in large size container because it is easy to manufacture with large-area. However, BF3 is a toxic gas and has limitations in increasing the gas pressure[2]. And in the case of using 10B thin film, due to the low absorption efficiency, it is necessary to construct a multi-layered thin film of several ㎛ thick[3]. For this reason, it is necessary to fabricate large-area sensor at low price in order to develop high efficiency neutron monitoring system. For this purpose, we have conducted a study on a hybrid system that combines PVT (polyvinyltoluene) to measure ㎓ -ray and sensors that react with neutrons to generate ㎓ -ray. The neutron reactors used in this study are boron, Cd and Gd, and the size of PVT is 100㎜×100㎜×5cm3. The detecting efficiency of nuclear materials in container using each materials was measured by MCNP. To calculate the detection efficiency, neutron (Cf-252, surrounded by 1-inch-thick HDPE) were generated at 2 m from the detector surface. As shown in the below figure, efficiency of Cd was the lowest and efficiency of Gd was the highest. As a result, it was found that 2 to 3 cps for 1 ng Cf-252 source, which is the efficiency of a general vehicle neutron detector, was satisfied, and the system can be configured using RPM and it also will be advantageous in terms of price.

ACKNOWLEDGMENTS

This research was supported by a grant from National R&D Project of "Research on Fundamental Core Technology for Ubiquitous Shipping and Logistics"funded by Korea Institute of Marine Science and Technology Promotion(PMS3791).

REFERENCES

[1] Timothy M. Persons, Gene Aloise, Neutron Detectors Alternative to using helium-3, Report to Congressional Requesters, GAO-11-753, pp. 1-48

[2] A. Lintereur, K. Conlin, J. Ely, L. Erikson, R. Kouzes, E. Siciliano, D. Stromswold, M. Woodring, 3He and BF3 neutron detector pressure effect and model comparison, Nuclear Instruments and Methods in Physics Research A, vol. 652, pp. 347-350.

[3] C. Höglund, J. Birch, K. Andersen, T. Bigault, J-C. Buffet, J. Correa, P. van Esch, B. Guerard, R. Hall-Wilton, J. Jensen, A. Khaplanov, F. Piscitelli, C. Vettier, W. Vollenberg, and L. Hultman, B4C thin films for neutron detection, Journal of Applied Physics, vol. 111, pp. 104908-1-8.

Primary author: Mr IK-HYUN, Kim (KRISO)

Co-authors: Dr LIM, Chang Hwy (KRISO); Dr PARK, Jong-Won (KRISO); Mr LEE, Jeong-Hee (KRISO); Dr LIM, Yong-Kon (KRISO); Dr MOON, Myung-Kook (KAERI)

Presenter: Mr IK-HYUN, Kim (KRISO)

Session Classification: Poster session