Contribution ID: **33** Type: **Poster Presentation**

Development of Absolute Epi-thermal and Fast Neutron Flux Intensity Detectors for BNCT

Thursday, 26 November 2020 17:04 (1h 46m)

BNCT is a promising cancer therapy which kills tumor cells while suppressing exposure dose to normal tissues. Normally, the neutron field of BNCT, which is produced by a nuclear reactor or an accelerator-based neutron source, has an energy distribution spreading within thermal, epi-thermal and fast neutron regions. Because epi-thermal neutrons are generally used for BNCT, we must measure the epi-thermal neutron flux intensity to evaluate the therapeutic effect and patient's exposure dose. In addition, we also have to measure the fast neutron flux intensity to evaluate the exposure dose that may be harmful to the human body. However, it is quite difficult to measure such intensities directly and accurately because there is no suitable neutron spectrometer and no activation material covering epi-thermal or fast neutrons separately. The objective of this work is hence to develop new detectors to precisely measure the absolute integral flux intensities of epi-thermal and fast neutrons.

An epi-thermal neutron detector we develop controls its sensitivity by using cadmium and polyethylene. A fast neutron detector controls by using cadmium, B4C and polyethylene. The shape of the epi-thermal neutron detector is a cube, each side of which is 5.52 cm covered with a cadmium sheet. However, the epi-thermal neutron detector is a little sensitive to fast neutrons. To clarify the fast neutron contribution, we develop the fast neutron detector. To extract only fast neutrons, the fast neutron detector consists of two sub-detectors, and the fast neutron intensity is estimated by making difference of the two sub-detectors. The shape of one of them is a cube covered with polyethylene with a side of 4.4 cm and that of the other is a cube covered with B4C with a side of 4.6 cm. Moderated neutrons are measured by activation reaction of 71Ga (n, γ) 72Ga of a GaN foil positioned at the center of the detector. Design calculations were carried out by MCNP5.

After fabricating the detectors, in order to test the performance of the epi-thermal and fast neutron detectors, verification experiments were conducted at KUR, Kyoto University and FNL facility, Tohoku University, respectively.

As the result, the epi-thermal neutron flux intensity could be measured with an error of 3.9 % by correcting the high energy neutron contribution with the calculated value. The fast neutron flux intensity could be measured accurately, that is, the experimental and calculated values agree well within the error range.

Primary author: Mr AOKI, Kazushi (Graduate School of Engineering, Osaka Univ.)

Co-authors: Mr TAMAKI, Shingo (Graduate School of Engineering, Osaka Univ.); Mrs KUSAKA, Sachie (Graduate School of Engineering, Osaka Univ.); Mr SATO, Fuminobu (Graduate School of Engineering, Osaka Univ.); Mr MURATA, Isao (Graduate School of Engineering, Osaka Univ.)

Presenter: Mr AOKI, Kazushi (Graduate School of Engineering, Osaka Univ.)

Session Classification: Poster