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[P22] Design and Construction of Epi-thermal Neutron Field with a Am-Be Source for Basic Researches for BNCT

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Recently, Boron Neutron Capture Therapy (BNCT) has been attracting more and more attention as a new type of radiation therapy. BNCT is a method for cancer treatment by irradiating tumor cells with the low-energy neutrons from outside of the human body after accumulating boron in the tumor cells. This therapy can selectively kill tumor cells suppressing the damage of normal cells. In BNCT, it is important to evaluate the characteristics of the neutron field of Accelerator Based Neutron Source (ABNS). This is because the characteristics of the neutron field, such as the neutron spectrum generated by ABNS, vary depending on the acceleration energy of the beam, the types of targets and moderators. Therefore, it is necessary to establish a method to evaluate the neutron field characteristics using a neutron spectrometer for ABNS-BNCT. To solve this problem, our research group has been developing a new low-energy neutron spectrometer using a position-sensitive proportional counter [1]. It is however difficult to carry out the experimental validation of the spectrometer, and thus it is essential to prepare an epi-thermal neutron field which is to be used also for basic researches of BNCT. The purpose of this study is to design and construct an epi-thermal neutron field. We employed an AmBe neutron source and the epi-thermal neutron field was designed by using Monte Carlo N-Particle Transport code (MCNP-5). The epi-thermal neutron flux and η value (ratio of epi-thermal neutron flux to fast neutron flux) were selected as the design indices to realize the optimal epi-thermal neutron field. In the design, various materials of aluminum fluoride, Teflon, carbon, iron and titanium were used as moderators, and covered with reflectors of lead and graphite. As a result of the design, the epi-thermal neutron flux was 13.7 n/cm²/sec, and the η value was 10.4. After the design the actual epi-thermal neutron field was constructed. Now, the experimental verification of the neutron field is in progress.

References

[1] I. Murata, H. Miyamaru, "Low-energy Neutron Spectrometer Using Position Sensitive Proportional Counter —Feasibility Study Based on Numerical Analysis"Nuclear Instruments and methods in Physics Research A 589,445-454(2008).

Primary author: Mr HIRAYAMA, Takahiro (Graduate school of Engineering, Osaka University)

Co-authors: FUJIWARA, Yu (Graduate school of Engineering, Osaka University); MURATA, Isao (Graduate school of Engineering, Osaka University); SATO, Fuminobu (Graduate school of Engineering, Osaka University); TAMAKI, Shingo (Graduate school of Engineering, Osaka University); KUSAKA, Sachie (Graduate school of Engineering, Osaka University)

Presenter: Mr HIRAYAMA, Takahiro (Graduate school of Engineering, Osaka University)

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