

Estimation of thermal neutron flux with thermoluminescent dosimeter

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The thermal neutron flux estimation in the BNCT is important, because the boron dose is evaluated from the thermal neutron flux using the $1/v$ behavior of the cross-section of the boron element. Also its high capture reaction probability shows therapeutic effects in the BNCT. The gold foil activation analysis is widely used method to estimate thermal neutron flux. However, this method needs additional instruments such as a high purity germanium detector, a liquid nitrogen cooling system and lead shielding blocks. And the cross-section of the gold element has resonances in the epithermal energy range. In this study, we propose the lithium fluoride based thermoluminescent detectors to evaluate thermal neutron flux with more wide range of $1/v$ behavior region with less complicated and labor intensive than the conventional method. The ^{252}Cf source was used to calibrate the TLD-600 and TLD-700 with cadmium sheets. The amount of incident thermal neutrons is validated aided by Monte Carlo simulations. The TLDs were placed with the 3 different shielding, i.e. without shield, one side shielded and both sides shielded. The gamma induced signals were corrected by subtracting TLD-700 signals from TLD-600 signals. Then the different shielding configuration enables to evaluate thermal neutron induced signals from them. The irradiation was repeated 3 times with the same condition. The estimation of incident thermal neutron flux to the TLDs was aided by Monte Carlo simulations. The calibration factor (TLD signals to thermal neutron flux) was evaluated by dividing corrected TLD signals by the thermal neutron flux.

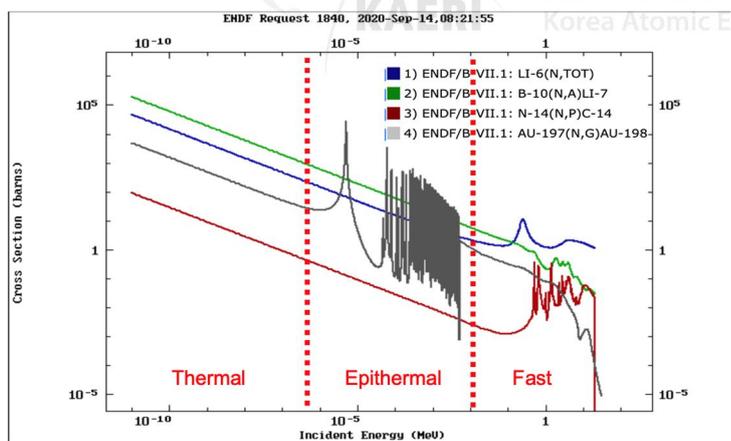


Fig. 1. The cross-section data of ^6Li , ^{10}B , ^{14}N , and ^{197}Au from ENDF/B-VII.1 (Graphs are from <https://www-nds.iaea.org/>)

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