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Neutron capture cross-section measurements of Th-232 using activation technique

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232Th-233U fuel cycle in connection with ADSS is one of the possibilities for power generation besides transmutation of long-lived fission products and incineration of long-lived minor actinides. The 232Th-233U fuel in AHWR and ADSS has an advantage over the present reactors based on uranium fuel from the point of thousand times less radio toxic wastes production. Besides these, thorium in the earth's crust is three to four times more abundant than uranium. Thus, it is a fact that 232Th is the only nucleus present in nature which can give rise to an excess of fissile material 233U in presence of either thermal or fast neutrons, and thus making it an excellent choice for nuclear reactors of the future. In the Th-U fuel cycle, the fissile nucleus 233U is generated by two successive β-decays after a neutron capture by the fertile nucleus 232Th. Thus, the production of fissile nucleus 233U depends on the 232Th(n,γ) reaction cross-section.
The literature survey shows that there is no neutron capture cross-section data for 232Th beyond 2.73 MeV except only one data is available at 14. 5 MeV. In view of this, the 232Th(n,γ) reaction cross-section at average neutron energies of 6.2±0.3 MeV and 16.2±0.4 have been determined for the first time using activation and off-line γ-ray spectrometric technique. The average neutrons of energies 6.2±0.3 MeV and 16.2±0.3 MeV were produced by 7Li(p, n)7Be* reaction using BARC-TIFR Pelletron facility at TIFR, Mumbai. The experimentally determined 232Th(n,γ) reaction cross-sections were compared with the evaluated nuclear data of ENDF/B-VII, JENDL-4.0 and JEFF-3.1 and were found to be in good agreement. The 232Th(n,γ) reaction cross-sections were also calculated theoretically using the TALYS 1.2 computer code and compared with the experimentally determined data.

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