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#07-113 The natIn(n, γ)116mIn reaction cross-sections - An important neutron monitor reaction

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The (n, γ) reaction cross-sections of Indium (In) isotopes are of prime interest for the study of neutron-induced nuclear data. The (n, γ) reaction cross-sections are crucial for upcoming nuclear technologies, like Accelerator Driven Subcritical Systems (ADSs) and Advance Heavy Water Reactors (AHWR) [1, 2]. Indium has extensively been used for the flux measurements in the neutron-induced reaction experiments. There is a need for improvement in the neutron monitor reaction data as the uncertainties in flux directly goes into the measured sample reaction cross-sections. For this purpose, production cross-sections of 116mIn isotope were measured using neutron activation [3] of natIn target following off-line γ-ray spectroscopy by using a pre-calibrated HPGe detector. The 27Al(n, α)24Na reaction is used for neutron flux monitoring purposes. Appropriate energies of proton beams were used from the 14UD BARC-TIFR Pelletron facility, Mumbai, India to generate 10.95 ± 0.67, $13.97 \pm 0.0.97$, 16.99 ± 0.88, and 20.00 ± 0.94 MeV average energy quasi-monoenergetic neutrons using 7Li(p, n)7Be reaction. Experimentally measured data from the present work have been compared with the existing data libraries such as ENDF/B-VII.1, JENDL-4.0, JEFF-3.2 and CENDL-3.1 [4]. The uncertainty and correlation between the present experimental data have been determined using the ratio technique of covariance analysis [5]. The results were also reproduced and compared with the theoretical nuclear modular codes like TALYS-1.95 [6] and EMPIRE-3.2.3 [7]. The present results show a good agreement with the theoretical as well as with the existing experimental data in different data libraries. The present findings are important for the improvement in the nuclear reaction data, advanced reactor design, dose estimation, and flux measurements.

Keywords —natIn(n,γ)116mIn reaction, natLi(p,n)7Be reaction for neutrons, cross-section, γ-ray spectroscopy, EMPIRE-3.2.3, TALYS-1.95, Covariance analysis.

References:

[1]. C.D. Bowman, Annual Review of Nuclear and Particle Science, 48, 505 (1998).

[2]. C. Rubbia, et al., CERN-AT-95-44-(ET) (1995).

[3]. K. Shibata, et al., Activation cross-section file for decommissioning of LWRs. JAEA, 47-52, (2016).

[4]. EXFOR, www-nds.iaea.org/exfor/exfor.htm.

[5]. S. Parashari et al., European Physical Journal A, 55, 51 (2019).

[6]. A. J. Koning, S. Hilaire, S. Goriely, TALYS user manual, A nuclear reaction program, NRG-1755 ZG PETTEN, The Netherlands (2015).

[7]. M.Herman et al., "EMPIRE: Nuclear Reaction Model Code System for Data Evaluation", Nucl. Data Sheets, 108 (2007) 2655-2715.

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