Seminar

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Institute for Plasma Research

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Title: Study of Cross-Section Measurement of Tin Isotopes with Covariance Analysis

Speaker: Dr. Zara Aftab
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Date: 30th April 2025 (Wednesday)

Time: 02.00 PM

Venue: Seminar Hall, IPR

Abstract

Production of charged particles like p, a, d etc. through fast-neutron-induced reactions impose a significant concern in fusion reactor development [1]. These reactions leads to the production of hydrogen and helium gases, along with the atomic displacements and nuclear transmutations, leading to microstructural defects like cavities that degrade material properties reduces service life, and compromise reactor safety [2]. For the reliable estimate of the production of these charged particles accurate nuclear reaction cross section data is needed. Along with this cross section data serve as a crucial input for the fusion reactor design, radiation shielding, and other nuclear engineering applications [3]. Moreover, it also provide valuable insight into particle–nucleus interactions, enhancing our understanding of nuclear forces and structure.

A thorough literature review revealed that there is large discrepancy between experimentally measured data and evaluated data libraries for several fusion relevant materials. Tin is one such materials, with limited data available for certain isotopes, and most of which measurements were taken long before. It plays a notable role in nuclear fusion research. It is commonly used as an alloying element with zirconium for reactor components and also serves as a crucial element in the superconducting material used in the ITER toroidal field magnet [4,5]. In this study, cross-sections of ^{117}Sn(n,p)^{117g}In, ^{118}Sn(n,α)^{115g}Cd and ^{120}Sn(n,α)^{117g}Cd isotopes were measured at 14.96 ± 0.027 MeV neutron energy, using neutron activation analysis. To assess the reliability of experimental result, uncertainty analysis was performed using covariance method. The measured data were then compared with evaluated data generated using different nuclear reaction models available in the TALYS code framework.

References:

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2. M.R. Gilbert, S.L. Dudarev, S. Zheng, L.W. Packer, and J.-Ch. Sublet“Transmutation, gas production, and helium embrittlement in material under neutron irradiation”, CCFE-PR(12)02
3. R.A. Forrest, “Data Requirements for Neutron Activation Part I: Cross-Sections,” Fusion Eng. Des., 81,2143(2006); http://dx.doi.org/10.1016/j.fusengdes.2006.01.001
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