Seminar

Institute for Plasma Research

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Title: Study of neutron induced reactions of different materials for reactor applications

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Date: 4 February 2025

Time: 2:00 PM

Venue: Seminar Hall, IPR.

Abstract

Nuclear data are fundamental to nuclear engineering studies, such as the design and safe operation of various nuclear systems such as Generation IV nuclear reactors, fusion reactors, accelerators and medical applications. Improved nuclear data are essential for the study of shielding problems, radioactivity produced, and decay characteristics of materials used in reactors, as well as for the more efficient operation of nuclear power plants. Nuclear data are divided into two main groups: Nuclear reaction data, which describe the interaction of neutrons, protons, or photons with target nuclei, and nuclear structure and decay data, which describe nuclear levels, half-lives, and radioactive decay radiations. Accurate knowledge of neutron-induced reaction cross-sections is crucial for the safe and efficient operation of nuclear reactors. These cross-sections provide fundamental data for reactor physics calculations, such as neutron transport, radio isotope production, and safety assessments. This work focuses on experimental techniques and recent advancements in measuring neutron-induced reaction cross-sections for various reactor materials, including fuels, structural materials, and neutron absorbers. There is a lack of cross section data at different neutron energies and available data have large discrepancy in published and evaluated nuclear data libraries. In present work, the neutron induced cross sections of isotopes of tungsten (W), zirconium (Zr), niobium (Nb), strontium (Sr) and rubidium (Rb) nuclides were measured using the offline γ-ray spectroscopic technique. The uncertainties involved in the cross section measurements were also calculated using covariance analysis. The measured reaction cross sections were predicated using various nuclear reaction models available in TALYS and EMPIRE codes.

References:

1. Mayur Mehta, N. L. Singh, Ratankumar Singh, R. Makwana, P. V. Subhash, et al., Activation cross section for ^{85}Rb(n,p)^{85m}Kr and ^{85}Rb(n,2n)^{84m}Rb reaction with uncertainty propagation and covariance analysis, *J. of Radioanalytical and Nuclear Chemistry, (2024)*
2. Mayur Mehta, N. L. Singh, Ratankumar Singh, Rakesh Chauhan, et al., Cross section of (n,2n) reaction for Niobium and Strontium isotopes between 13.97 to 20.02 MeV neutron energies, *Applied Radiation and Isotopes 182, 110142, (2022)*
3. Mayur Mehta, N. L. Singh, R. K. Singh, Siddharth Parashari, P. V. Subhash, et al., Measurement of ^{90}Zr(n,2n) ^{89}Zr and ^{90}Zr(n,p)^{90m}Y reaction cross sections in the neutron energy range of 10.95 to 20.02 MeV, *J. of Radioanalytical and Nuclear Chemistry, 328, 71, (2021)*
4. Mayur Mehta, N. L. Singh, A. Gandhi, P.V. Subhash, et al., Neutron capture cross section of ^{186}W isotope in the energy range from 0.6-3.2 MeV with covariance analysis, Radiation Physics and Chemistry, RPC-D-23-01362 (In review)