

ORNL EVALUATION OF THE RESONANCE PARAMETERS OF ^{238}U IN THE NEUTRON ENERGY RANGE FROM 0 KEV TO 20 KEV AND ITS IMPACT IN REACTOR CALCULATIONS.

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The ^{238}U neutron resonance parameters currently used in the most recent evaluated neutron data libraries are those obtained by Moxon and Sowerby in the framework of a task force formed in 1982 by the Nuclear Energy Agency Nuclear data committee (NEANDC) with the aim of eliminating the discrepancies in the neutron widths and in the experimental capture cross sections. In 1994 the NEANDC concluded that the major discrepancies were removed by the work of the task force, and the Moxon-Sowerby evaluation was accepted. Recently it was found that most of the libraries (ENDF/B-VI-8, JEFF3-0 and JENDL3-2) show a systematic and still unexplained keff underprediction for thermal LWR. Accordingly, it was decided, in the framework of a Working Party on International Data Evaluation Cooperation (WPEC), to reexamine the ^{238}U resonance parameters along with some other nuclear data (mainly ^{235}U , H_2O , ^{16}O). As a participation of ORNL in this international effort, and also in the framework of the ORNL Criticality Safety Program, a new evaluation of the ^{238}U resonance parameters was performed in view of the improvement of the data in the energy range thermal to 10 keV (Moxon-Sowerby energy range) and to extend the resolved resonance range to 20 keV. The analysis of the experimental data was performed with a new version of the Bayesian code SAMMY allowing an accurate calculation of the multiple scattering effects in the experimental capture cross section and of the Doppler broadening of the resonance by using a crystal lattice model. The preliminary results, obtained from the sequential SAMMY analysis of the Olsen et al. and of the Harvey et al. ORELA high resolution transmission data, and of de Saussure et al. capture cross section data, in the energy range thermal to 20 keV, were combined to some new evaluations of the cross sections in the high energy range (Bruyeres-Le-Chatel, France , Los Alamos National Laboratory, USA). The calculation using the new files showed a remarkable improvement in reactivity predictions compared to the previous evaluations.

The objective of the paper is:

1/ to give a short description of the new evaluation of the resonance parameters and to compare the calculated cross sections to those calculated with the previous evaluations. The resonance parameters reproduce a thermal capture cross section value of 2.68 b compared to the value of 2.71 b in ENDF/B-VI, JEFF-3 and JENDL-3, and the infinitely diluted resonance capture integral is lower by about 1%. The elastic scattering cross section is higher by about 2% on average in the energy range up to 20 keV.

2/ to give the results of various benchmarks calculations performed with the new resonance parameters associated to the most recent evaluations of the cross sections in the unresolved and high energy regions.