Topic number 6

New Evaluation of ^{238}U Resonance Parameters[1]

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This work is performed in the framework of the Nuclear Safety Criticality Program at the Oak Ridge National Laboratory, and is a participation in the WPEC/Sub-Group aimed to evaluated Nuclear Data for improved LEU-LWR reactivity predictions.[1] The neutron transmission measurements of J.A. Harvey et al.,[2] performed at the 200 m neutron flight path of the Oak Ridge Electron Linear Accelerator(ORELA) with a nominal resolution of about 0.03 ns/m for three samples of thicknesses 0.1748 at/b, 0.0396 at/b and 0.01235 at/b, respectively, were analyzed with the Reich-Moore analysis code SAMMY[3] in the energy range 10 keV to 20 keV. The experimental resolution was good enough to separate about 80% of the s-wave resonances. The fit to the experimental data was obtained by using 361 s-wave resonances and 1079 p-wave resonances, which correspond to an s-wave average resonance spacing of about 27.7 eV. The s-wave resonance spacing is 21.2 eV in the ENDF/B-VI evaluation of the energy range up to 10 keV. The 20% missing s-wave resonances in our evaluation are those with small neutron widths. The values of the s-wave and p-wave strength function in the energy range 10 keV to 20 keV are 1.095×10^{-4} and 1.710×10^{-4}, compared to 0.947×10^{-4} and 1.570×10^{-4}, respectively, in the ENDF/B-VI evaluation. The next step of the evaluation was to include in the experimental data base the experimental capture cross section published in 1973 by G. de Saussure et al.[4] and in 1991 by R.L. Macklin et al.[5] These data were not fully analyzed at the time of their publication due to the difficulties of an accurate calculation of the self-shielding and multiple scattering effects in the sample used in the capture cross section measurements. The new version of SAMMY allows an accurate calculation for these experimental effects. The results of the analysis have shown that a good fit of the experimental data cannot be obtained without a background cross section of about 10% of the measured cross section; that could be due to an underestimation of the p-wave contribution. The same trend is observed in the energy range 4 keV to 10 keV with the ENDF/B-VI resonance parameters. The full paper will describe the ^{238}U evaluation and its impact in benchmark calculations for criticality safety applications.

References

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