IEC-207

Proposal for a subgroup to address remaining issues on ^{235}U evaluation

Suggested participants:

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Report on the activities of subgroup 18 (^{235}U Epithermal Capture) is on its final stage. Summary of the work that has been accomplished is:

1. The problems concerning the capture cross section are fully understood:
   a. An average capture[1] width (38.2±1.8 meV) has been obtained from the SAMMY[2] analysis of a large set of experimental differential data, based on well-resolved time-of-flight experiments. This agrees with the values obtained by M. C. Moxon from the analysis of selected resonances in 0-20 eV, and with value obtained independently in Release 3 (0-100 eV) by adjusting the capture cross section upwards to match the bin-averaged capture.
   b. The average capture width increased by 3% with the inclusion of integral data in the experimental data base.[1] The width is now 39.4±2.0 meV, agreeing (within the uncertainties) with the previous value.
   c. The capture resonance integral obtained from these parameters is 140.9 b, giving an alpha value of 0.509, consistent with integral measurements.
   d. The capture widths show fluctuations on the order of 10%. Such fluctuations are considered to be acceptable in order to provide the best possible fit to the differential data. Moxon has arrived at an alternative

fit using a fixed value of the radiation width, achieving comparable χ^2 (goodness-of-fit) values, but at present there is no evidence indicating a technological difference between the two approach.

2. Combining the resonance parameters into a unique set has solved the problem of discontinuity at the boundaries between the eleven disjoint sets in previous ENDF/B-VI releases. This simplifies the representation of the distant level contribution.

3. The ORNL evaluation[1] reproduces below 0.1 eV the shape of eta expected by Santamarina.[3] The Gwin 1990 eta data are well reproduced in the energy range below 1 eV. The only problem is from the Wartena data in the high energy wing of the 0.3 eV resonance where the data are questionable.

4. Good agreement in benchmark results for highly-enriched thermal assemblies and improved results for intermediate spectrum cases. Some studies continue to show poorer agreement in low-enrichment cores, but that effect cannot be reliably disentangled from ^{238}U cross section questions.

In view of work that remains to be accomplished we propose a subgroup (**^{235}U Unresolved Energy Range**) to address the following issues:

1. Resonances at higher energy are partially resolved. The effect of the pseudo nature of the resonance parameters on the accuracy of the calculated self-shielding factors should be evaluated, and compared with a conventional treatment in terms of average parameters.

2. Is multilevel-multichannel treatment needed in the unresolved range to improve the accuracy of the self-shielding factor calculation?

3. The unresolved resonance region should be reevaluated by taking into account the very accurate total cross section obtained from Harvey transmission data[4]; this could modify the fission and/or the capture cross sections by a few percent. Work on this is in progress at ORNL.

4. Reconsider the problem[5] of the ENDF/B-VI fission standard of the ENDF/B-VI standard working group. *If this fission standard is retained with its claimed accuracy, then the inconsistency between the standard values and the evaluation remains to be resolved, and the problems*

concerning the capture cross section will reappear. The problem will also show up in the unresolved resonance region. The current ENDF/B-VI values are based on the alpha measurements of Corvi[6] and of Muradyan.[7] The important data of Beer[8] obtained at Karlsruhe with a very high resolution were not considered. These data, in excellent agreement with deSaussure[9] data, are 6 to 7% higher than Corvi data. Taking for alpha some kind of average value from Corvi, Beer and de Saussure will give fission cross section 2-3% smaller than the standard value, by keeping the total cross section at the accurate value of Harvey.

5. More highly enriched, preferably homogeneous, intermediate-energy benchmarks are needed to test the adequacy of new unresolved-resonance cross sections. Previous work has been hampered by uncertainties in the ^{238}U cross sections in low-enriched benchmarks, and by the approximate nature of the experimental corrections to inhomogeneous assemblies and central-worth measurements. The subgroup could examine new, formerly proprietary benchmarks as they are made available, and possibly encourage the release of more of these.

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