INTERNATIONAL EVALUATION COOPERATION
PROGRESS REPORT OF THE SUBGROUP ON

"^{239}Pu fission cross section between 1 keV and 100 keV"

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The ^{239}Pu fission cross-section measured by WESTON (NSE 88, 567, 1984) in excellent resolution conditions is about 5 % lower than almost recent measurements and all major evaluations (JENDL3, ENDF86, JEF2) in the range 1 keV - 100 keV that is of particular importance for FBR calculations (Keff control rod worth, void coefficient) and for MOX recycling in LWR or HCLWR.

In view to solve this problem the researches are progressing along two axes :

1. Critical examination of WESTON's measurements.
2. Examination of all other sources of information relating to the fission cross section : competitive cross section data (when existing) and integral data.

1. Critical examination of WESTON's experiment

This is a TOF experiment performed on ORELA in 1984 [1]. The shape of the neutron flux was measured relative to a BF3 up to 1 keV (1/v shape) and relative to a Li^6 glass scintillator at higher energy. The σ_f curve is normalized to the thermal energy. The following aspects can be considered as possible sources of errors for this experiment designed for a measurement at high energy :

- B^{10} sample thickness, self absorption,
- dead time.

On the other hand some question is put on the normalization itself. As a fact if one compares for the range 100 eV - 1000 eV (that is the range for the flux measurement (% B^{10} and % Li^6) intercomparison the fission integral values obtained by GWIN and WESTON, in similar experimental conditions, ones quotes 9268 b.ev [2] + 9365 b.ev [3] and 8996 b.eV respectively, revealing a 4 % difference not in contradiction with the errors quoted for both series of experiments.

GWIN
WESTON 1.9 % normalization
1 % systematic ==> ~ 2.9 %
0.15 statistic

(GWIN's experiment cannot be considered as a reference because of a too large uncertainty affecting the B^{10} content of the neutron detector).

Experimental programs have been planned both in OAKRIDGE and GEEL to check the normalization. The GEEL's program has just been completed.

It consists en 2 experiments with different geometries ("low" geometry, "2π" geometry ie, the one of WESTON'S experiment). These experiments are characterized by the use of thin B^{10} deposits (~ 10 $\mu g/cm^2$) accurately measured.

A preliminary preanalysis of one experiment confirms the first guess of a 4% renormalization.

On the other hand, M. DERRIEN, working at JAERI, indicates in the comments on the ^{239}Pu resonance parameter reevaluation, that the experimental program planned at OAK-RIDGE has been performed. From the figures given a renormalization of +3.4% can be derived.

2. Examination of all other sources of information

Microscopic

Recent transmission experiments performed at ORELA (consistency with the fission measurement) led to the adoption of an other reference for what concerns the total x-section. The adoption of this new reference together with another (greater) scattering radius is the origin of a new DOM parametrization (DOMP90) resulting in a significantly different compound nucleus formation x-section. This one is 10 % - 15 % (fig. 4 of reference 1) lower than in JEF2 or ENDF B6 in the energy range of interest.

It has been decided to perform 2 model evaluations using this new (DOM) parametrization to describe the neutron channel :

1. One based on WESTON's fission data.
2. Another one based on ENDF B6, for the fission channel description.

These 2 model evaluations are supposed to represent 2 different syntheses of the experimental information that proved to be limited to the neutron and the fission channels concerning ^{239}Pu in the range 10 keV - 100 keV. As a fact, a specific study has shown that other types of data such as alpha or the data of competitive reactions (capture, inelastic ...) are not accurate enough to be used as references in model calculations.

Integral

The integral data are another source of information. That's why the two model evaluations will be checked again a sery of integral data well adapted to this objective.

The quality of the conclusions drawn from this benchmarking is strongly dependent on the fact that the compound nucleus formation cross section data recommended for the range 1 keV - 500 keV are the correct ones. This point relating the total cross-section data and the derived OMP are key points in this validation.