Minutes of Meeting of sub-group 5 : "239-Pu Fission Cross Sections between 1keV and 100 keV" December 4, 1990

Present were E. Fort (Chairman) of Cadarache, M. Caro of PSI Switzerland, H. Derrien of CEA (retired), M.Kawai of Toshiba Corp., C. Lagrange of Bruyères-le- Chatel, A. Tobias of Nuclear Electric (U.K.), C. Wagemans of Geel, and L. Weston of ORNL.

E. Fort opened the discussion and explained how the experimental, theoretical and integral aspects of the problem in the Pu-239 fission cross section would be considered. The basis of the problem is that the fission cross section measurements of Weston and Todd (ORNL, 1984) are systematically lower than the average of the previous measurements by about 4%.

Experimental Aspects : The discussion of the experimental aspects of the problem was led by H. Derrien, C. Wagemans and L. Weston. Weston discussed his fission cross section measurements and provided the information and plots given in Appendix 1. The conclusion was that the significant discrepancy with previous data was that the normalization of the data was discrepant and not the shape versus neutron energy. The normalization of the Weston data tended to be confirmed not only at 2200m/sec but also by the new transmission measurements of J.A. Harvey of ORNL and also by the agreement with the ratio of the Pu-239 to U-235 fission cross sections in the MeV region of neutron energy.

Derrien discussed his Reich-Moore parameter fit for the resonance region of Pu-239. He pointed out the consistency between the Harvey transmission measurements and the Weston and Todd fission measurements. The background cross section problem in the earlier Blons data was pointed out and the fact that this problem made the Blons data high by about 4%.

C. Wagemans of Geel discussed the experimental problems and the available data base for Pu-239 fission. His observations, plots and tables are given in Appendix 2. Wagemans also pointed out that the basic discrepancy was in the normalization of the data. It was also pointed out that the available data base is not so good that a 4% difference in normalization is unreasonable. Only two measurements by Gwin (ORNL, 1971, 1976) cover the complete neutron energy region from thermal to 30 keV in one experimental measurement. Techniques have improved significantly since the Gwin measurements and more accurate average values of the fission cross section versus neutron energy can now be measured.

The conclusion from the experimental aspects was that the basic discrepancy is one of normalization only. Both ORNL and Geel will carry out experiments to obtain data with which to better normalize previous measurements. Efforts will be made to complete the measurements by the end of 1991.

THEORETICAL EVALUATION ASPECTS

H. Derrien discussed the Pu-239 cross sections in the energy range from 1 to 500 keV. The Harvey (ORNL) transmission measurements were analyzed and corrected for self-sheilding such that a total cross section was obtained with an accuracy of about 2%. A report covering this work appears in Appendix 3. This is a significant improvement in the data base.

C. Lagrange discussed his calculation of optical model parameters which was meant to reproduce the total cross section as derived by Derrien and the fission cross section by Weston. The optical model parameters and fits to the data appear quite consistent. Information concerning the calculation is given in Appendix 4.

M. Kawai reported on the work of himself and T. Nakagava to survey the cross sections for Pu-239 in the energy region 1 - 100 keV. The results of this survey are in Appendix 5. It was noted that the uncertainty in the competitive cross sections, particularly the capture cross sections or alpha, were large compared to the fission cross sections so that little constraint would be placed on the fission cross sections.

INTEGRAL ASPECTS

E. Fort discussed the integral aspects of the Pu-239 fission data. Of course, a simple lovering of the fission cross sections in evaluations will cause discrepancies with integral experiments. Since the nev optical model calculation of Lagrange indicate that inelastic and capture cross sections may also need to be lowered, perhaps effects will compensate. E. Fort will perform statistical calculations with the parameter of Lagrange and P. Young of LANL has been asked to do the same for the ENDF/B-VI data base. Benchmark calculations will be performed by E. Fort at Cadarache on the two sets of model calculations. Expected completion of this work is July 1991.

SUMMARY OF CONCLUSIONS :

Experimental : It was concluded that the major discrepancy between the Weston and previous data is one of normalization. Both Geel and ORNL will carry out nev measurements to determine accurate normalization integrals for the Pu-239 fission cross sections. The average cross section measurements should extend to at least 200 keV. Results should be available by the end of 1991.

Theoretical : C. Lagrange will complete the calculation of nev optical model parameters. E. Fort and P. Young will perform statistical calculations considering respectively the Weston data and ENDF/B-VI as reference fission cross sections. Completion should be by March 1991.

Integral : Benchmark calculations will be performed in Cadarache by E. Fort to test the above two evaluations. Expected completion date is July 1991.