

Status of BROND Project (May 2003)

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The present status of the Russian BROND project is briefly summarized. Activity under the project is developed in the following directions:

- Measurements of the most important nuclear data.
- Development of the BROND-3 library.
- Evaluations for intermediate energies.

The results obtained during the last year and the plans of future works are revived below.

Measurements of nuclear data

1. Measurements of the relative and total yields of delayed fission neutrons were finished the last year for U-238, Pu-239, Np-237, and Am-241 in the energy region from 14.5 to 18 MeV (Piksaykin V. et al., IPPE). These data are being analyzed now and they will be used together with the previous measurements at lower energies for the systematics and more accurate evaluations of energy variations of delay neutron yields.
2. Measurements of the fission neutron spectra were performed for U-238 at the incident neutron energies 6 and 7 MeV (Svirin M. et al., IPPE). During this year such measurements will be done at the energy 9 MeV too. The data obtained will be used for more accurate estimations of the fission neutron spectra at energies of the second and third plateaus and to test of the multi-chance neutron emission model developed at IPPE.
3. Measurements of the leakage neutron spectra for the Cf-252 neutron source were performed in the last year for the thick lead sphere with a diameter of 50 cm (Zhuravlev B. et al., IPPE). Unfortunately, the statistical accuracy of these measurements was not good enough because of a low intensity of the neutron source and the measurements are being continued now with a new source of higher intensity. They should be finished to the end of the year and the results obtained will be used together with previous data for smaller spheres as the benchmark tests of new BROND-3 files for lead and bismuth.

Development of the BROND-3 library

1. The development of powerful fast reactors and intensive spallation-neutron sources with the heavy-metal liquid coolant definitely requires more accurate data than available ones for the neutron cross sections of lead and bismuth. A new revision of the BROND-3 files for Pb-206, -207, -208 and Bi-209 were performed during the last year in which the recent precise measurements of the neutron total cross sections at LANL for natural lead were taken into account. A special attention was devoted to the excitation functions of low-lying levels at near threshold energies, where differences between the previous evaluations are especially large. New files are being tested now on the available reactor and transmission benchmarks and they will be adopted to the BROND-3 library in accordance with the obtained results.
2. The analysis of the new BROND-3 files for U-238 and Pu-239 was continued. Some more precise evaluations were performed for the neutron total cross sections, the delayed neutron yields and the fission neutron spectra at regions of the second and third plateaus. Main goal of the analysis is a consistent determination of uncertainties and covariance matrices for the most important cross sections on the basis of the new method of unrecognized error estimations developed at IPPE.
3. A revision of evaluations for most important minor actinides is continued. New BROND-

3 files for Pu-240 and Pu-242 were compiled during the last year and the files for Cm-242 and Cm-245 will be prepared to the end of the current year.

4. Re-evaluations of the BROND files for the most important fission products were started in the last year. The goal of this activity is an improvement of the inelastic scattering and threshold reaction evaluations in accordance with the remarks prepared by the subgroup 21. Revised evaluations were performed for isotopes Tc-99, Ru-100, -101, -102, -103, -104, Pd-104, -105, -106, -107, -108, -110. New evaluations for samarium and neodymium isotopes will be finished during the year. The total amount of revised BROND-3 files should be about 50 to the end of the next year.

Evaluations for intermediate energies

Compilation of the neutron data file for Pu-240 in the energy range up to 150 MeV was completed during the last year. The similar file for Np-237 will be finished to the end of this year. The same approaches were used for these evaluations as applied before for the files of Th-232, U-238, and Pu-239. Now this activity is supported by the ISTC Project-1732, in accordance with which the Am-241 file should be added to the listed above to the middle of the next year.

In collaboration with the ITEP (Moscow) and GSI (Darmstadt) we are also working on a revision of the intranuclear cascade model to obtain a consistent description of experimental data on neutron spectra and observed isotopic yields of fission fragments and spallation reaction products. Available simulation codes for such processes give strongly divergent results and these contradictions of calculations should be removed, if we want to produce reliable evaluations of nuclear data for energies above 150 MeV. This activity is supported now by the Project ISTC-2002.