



XA9950644

## FAST CRITICAL ASSEMBLY NEUTRONS FISSION CROSS-SECTIONS OF PLUTONIUM, AMERICIUM AND CURIUM ISOTOPES

*E.F.Fomushkin, G.F.Novoselov, V.V.Gavrilov, V.P.Egorov,  
M.I.Kuvshinov, B.N.Polynov*

There were measured fast neutron integral fission cross-sections for fourteen transuranium isotopes: Pu-237, Pu-240, Pu-242, Pu-243, Pu-244, Am-241, Am-242m, Am-243, Cm-243, Cm-245, Cm-246, Cm-247, Cm-248. The spherical critical assembly KS-I was used as a source of fast neutrons; assembly material - U-235 of 90% enrichment, external radius - 9.363 cm, mass - 18792g. According to its characteristics the KS-assembly is the analogue of Lady Godiva reactor (USA).

In the KS-I assembly there is available the central cavity, 2.8 cm long, where the layer of the investigated isotope and the layer of U-235 or Pu-239, used as a frame, were placed back-to-back. For these measurements there were produced the layers of U-235, isotopes of plutonium, americium, curium which are highly enriched by the basic isotope. The enrichment was executed on SM-2 electromagnetic separator. For the majority of the isotopes under investigation the enrichment was not worse than 98%, for frame samples and Pu-239 - not worse than 99.99%. The number of nuclei in the layers was determined mainly by alpha-spectroscopy methods. In some cases there was used gamma-spectroscopy or "weighting" by the reaction of nuclei fission by thermal neutrons. To register fission fragments there were applied dielectric track detectors - silicate glasses which are not sensitive to alpha-, beta-, gamma-, neutron- radiation.

The measurement results can be used for normalization of energy dependence of fission cross-sections, for correction and selection of estimated data files, for systematization and extrapolation of heavy nuclei fission characteristics etc.

## INTEGRAL NEUTRON FISSION CROSS-SECTION MEASUREMENT FOR Pa-232 AND Np-238 NEAR THE THERMAL POINT

*Andreev M.F., Abramovich S.N., Bol'shakov Yu.M., Gavrilov V.V., Krylov N.G.,  
Kunitsina I.K., Novoselov G.F., Serov V.I., Fomushkin E.F.*

There were measured integral neutron fission cross-sections of Pa-232 and Np-238 near the thermal point as well as supercadmium neutrons fission cross-sections (resonance integral). The buildup of the specified actinides was implemented through the reaction of  $U-238(p,n)Np-238$  and  $Th-232(p,n)Pa-232$  at the bombardment of thick targets by the protons accelerated up to 12 MeV at tandem electrostatic accelerator. The separation of the actinides buildup was performed by the method of chromatography. As a source of thermal neutrons there served a polyethylene block, aimed at moderation of fast neutrons, which were obtained as a result of irradiating beryllium target by the deuteron beam of the electrostatic accelerator, its energy being equal to 11.5 MeV.

The measurements were performed by the relative method. The standard layer of U-235 was used as a frame. Fission fragments were registered by the dielectric track detector. There were analyzed time dependence of the numbers of fissions in the layers of Pa-232 and Np-238. Moreover, there was separated the exponential component, corresponding to beta-decay period of the appropriate isotope. As a result



XA9950645

of measurements there were obtained the following values of neutron fission cross-sections near the thermal point:

fission cross section of Pa-232 is  $(970 \pm 60)$  b, fission cross section of Np-238 is  $(2110 \pm 74)$  b; the values of resonance integrals were as such: fission resonance cross section of Pa-232 is  $(915 \pm 330)$  b, fission resonance cross section of Np-238 is  $(905 \pm 48)$  b.



XA9950646

## **ABOUT POSSIBILITY OF RADIATION CAPTURE AND FISSION CROSS-SECTION MEASUREMENTS FOR ODD-ODD ACTINIDES**

*Abramovich S.N., Andreev M.F., Fomushkin E.F.*

In the report there is discussed the unfavorable situation with the data on fission and radiation capture cross-sections for odd-odd short-lived actinides of Pa-232, Np-238 and Am-242g as well as the difficulties of the experimental investigations of these nuclei characteristics. There is proposed the approach towards the measurement of these cross-sections, which is based on the analysis of the storage curves of Pa-232 and Pa-233 (at Pa-231 embedding), Np-238 and Np-239 (at Np-237 embedding) and Am-242g and Am-243 (at Am-241 embedding) in the high-flux reactor of the thermal column. The registration of the storage curves is implemented through the yield of gamma-quanta, accompanying the decay of the corresponding nuclei. The spectrometry of gamma-quanta is performed with the aid of germanium detectors.



XA9950647

## **MEASUREMENTS OF LEAKAGE NEUTRONS SPECTRA FOR SPHERICAL ASSEMBLIES OF U-235 (90 PERCENT), U-235(36 PERCENT), AND Pu-239(98 PERCENT)**

*A.M.Shvetsov, V.P.Egorov, E.F.Fomushkin, M.I.Kuvshinov, A.N.Zakharov*

The proportional gas counter of recoil nuclei, intended for measurement of spectra of neutrons, is developed and manufactured. Relative energy resolution of the counter constituted 3.8%.

To calculate a response matrix, used at neutron spectra unfolding from amplitude apparatus distributions, there was developed SUPREMAC program (Stringent Universal Program for Response Matrix Calculation). The program is based on the employment of Monte-Carlo method. With its help there are calculated neutron response functions for gas proportional counters of cylindrical or spherical form for any neutron field geometry: isotropic distribution; plane-parallel beam falling at any angle to the counter axis; point source positioned at any place as related to the counter. The calculations can be performed for any pressures combination of the following gases: hydrogen, methane, argon, krypton, He-3, He-4. There are taken into account the following effects: "wall" effect; smooth fall of the gas multiplication coefficient in the area of "work volume-dead region" transfer; spread of neutrons and reaction products energy; absorption and repeated scattering of neutrons in the counter gas etc.