the datum 0.38±0.24 b would be changed becomes to 0.15±0.07 b, which is consistent with present measurement.

Present measurement of the cross section for the m_1+g state is about 10% lower than the data measured by other laboratories (BNL-325, 1971 and 1984).

(3) Present measurements and other data(BNL-325, 1971 and 1984) for $^{94}Zr(n,\gamma)^{95}Zr$ reaction are listed in Table 4. The present result is in agreement with the data of BNL-325 in the range of measured errors.

Reference

[1] Richard B.Firestone,Virginia S.Shirley. Table of Isotopes eighth Edition, March 1996

Table 4 The cross-section of $^{94}Zr(n,\gamma)^{95}Zr$ reaction

Time	Author	Cross section / b
1952	H.Pomerance	0.08±0.04
1955	W.A.Brooksbank	0.06±0.01
1960	W.S.Lyon	0.075
1970	M.D.Ricabarra	0.063±0.008
1971	R.H.Fulmer	0.052±0.003
1973	D.C.Santry	0.0475±0.0024
1978	R.Kundberg	0.052
1978	R.E.Heft	0.055±0.002
1982	J.M.Wyrick	0.0494±0.0017
1971	BNL-325	0.056±0.004
1981	BNL-325	0.0499±0.0024
1998	Present work	0.053±0.002

Chain Yields from 19.1 MeV Neutron-induced Fission of ^{235}U

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【abstract】 *Chain yields for 35 mass chains were determined for the fission of ^{235}U induced by 19.1MeV neutrons for the first time. Absolute fission rate was monitored with a double fission chamber; fission product activities were measured by HPGe γ-ray spectrometry. Threshold detector method was used to measured the neutron spectrum in order to estimate the fission events induced by break-up neutrons and scattering neutrons from the environment. A mass distribution curve has been obtained.*

Introduction

The fission product mass distribution of ^{235}U has been extensively investigated, for some fission induced by monoenergic neutrons, but no more than 19 MeV neutron [1],[2]. In the present work, the chain yield of ^{235}U fission induced by 19.1 MeV neutrons was measured by means of γ-ray spectrometry.

1 Experiment

The experiment was carried out at the 2×1.7 MeV Tandem ,CIAE. The 19.1 MeV neutron was produced by $T(d,n)^4He$ reaction. The Tritium-Ti target, which was used to produce neutrons by the bombardment with the deuteron beam, was of the size *Φ*10 mm and 5.2 mg/cm^2 in thickness. The deuteron beam energy was 3 MeV. The neutron spectrum was measured by threshold detector method in order to estimate the fission events induced by the background neutrons from the $T(d,np)^3H$ reaction and from the scattering by the environment. The ratio of background neutron fission events to 19.1 MeV neutron fission events was estimated to be 0.574:1.

The sample used in the irradiation were *Φ*16 mm disks of uranium metal of about 2 g, the abundance of Uranium isotopes is 90.2% for ^{235}U, 1.1% for ^{234}U, 0.3% for ^{236}U and 8.4% for ^{238}U. The uranium disks were sealed in a pure Al foil of 0.2 mm thickness. The sample, which was sandwiched between two standardized thin samples to monitor the fission rate absolutely[3], was mounted in a double fission chamber. The standardized thin samples were made of the same uranium as the thick ones. The double fission chamber was covered with Cd of 1 mm thick in order to shield it from the thermal neutrons from the environment. 4 samples were irradiated for a period about 30 hours at a distance of about 5 cm from the neutron source in the direction of zero degree.

After the irradiation of γ-ray activities, the samples were measured by HPGe γ-spectrometers in turns. The γ-ray spectra were collected successively over a period varying from 30 seconds up to two months to encompass the wide range of half-lives of fission products involved, and to eliminate the cross interfering of the γ-ray from the product nuclides of almost the same energy which can not be resolved by the HPGe detector. And then, the γ-ray spectra were analyzed by the decay program SPAN[4]. The fission yields were obtained by program FYAUTOLS.

Table 1 Chain yields from 19.1MeV neutron-induced fission of ^{235}U

mass number	Yields / %	error
84	0.61	±0.16
85	1.49	±0.07
87	2.76	±0.04
88	3.21	±0.04
89	3.90	±0.05
91	3.87	±0.04
92	4.49	±0.09
93	4.22	±0.07
94	4.19	±0.05
95	4.54	±0.04
97	4.77	±0.03
99	5.6	±0.03
101	3.83	±0.04
103	3.06	±0.03
104	3.33	±0.06
105	2.92	±0.06
112	2.31	±0.11
115	2.02	±0.06
117	1.65	±0.11
127	2.29	±0.07
128	2.55	±0.64
129	2.79	±0.09
131	4.04	±0.54
132	3.82	±0.03
133	5.21	±0.03
134	6.25	±0.47
135	5.44	±0.04
138	4.38	±0.12
140	3.93	±0.04
142	2.97	±0.05
143	3.17	±0.05
146	1.54	±0.12
147	1.71	±0.07
149	0.85	±0.05
151	0.64	±0.05

2 Results and Discussion

The chain yields of 35 product mass chains were obtained. They are presented in table1. The fission product γ decay data used in these measurements were taken from *The Table of Isotopes (8th)*[5]. Corrections were made for coincidence losses, pile-up losses in the counting system, influence of the background neutrons, self absorption of γ-ray, independent yields, and influnence from other uranium isotope. The chain yields measured was plotted in Fig. 1. The sum of the yields directly measured was 61.1% for the light mass group, and 53.2% for the heavy mass group. Including the mass yields not measured but obtained by interpolating or extraporlating, the sum was 100.4% for the light mass group and 98.8% for the heavy mass group. Both of them are in good agreement with 200%. This demonstrates that we monitored the absolute fission rate and detected fission products to a very good precision. The mean mass numbers are 97.9u and 133.8u for the light and heavy mass group respectively, which give the mean fission neutron number $\hat{\nu}$=4.3. To compare our data with other data published in literatures, some product yields published by other authors[6,7] are also shown in Fig. 1. They display the dependence of fission yield with neutron energy.

3 Acknowledgement

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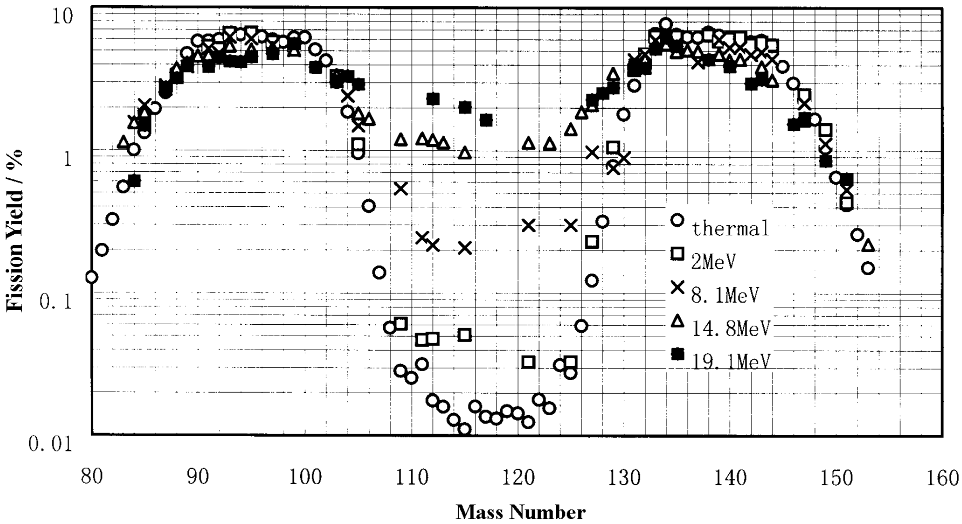

Fig. 1 Chain yields from monoenergetic-neutron-induced fission of ^{235}U

Evaluation of Complete Neutron Nuclear Data for $^{204,207}Pb$

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【abstract】 *The complete neutron data were evaluated in the energy range from 10^{-5} eV to 20.0 MeV for ^{204}Pb and ^{207}Pb. The data include total, elastic, nonelastic, total inelastic, inelastic to 11 and 16 discrete levels, inelastic to continuum states, (n,2n), (n,3n), (n,n'p), (n,p), (n,t), (n,α) and capture cross sections. The angular distributions of secondary neutron, the double differential cross sections (DDCS), the gamma-ray production data and the resonance parameters are also included. The evaluated data were adopted into CENDL-3 in ENDF/B-6 format.*

Introduction

Lead is a very important structure material in nuclear fusion engineering. The complete neutron nuclear data were evaluated on the basis of both experimental data measured up to 1999 and theoretical calculated data with program UNF[1]. The evaluated data were adopted into CENDL-3 in ENDF/B-6 format.

For natural lead, the data of all reaction channels are in very good agreement with the sum of the all isotopes′ data weighted by the abundance in the error range.

The level scheme is given in Table 1, selected from new data of Ref. [2].