

## Japan Charged-Particle Nuclear Reaction Data Group (JCPRG)

### EXFOR : Recent Compilation List (Added in Oct 2004)

EXFOR is a world-wide database for experimental neutron induced, charged-particle induced and photonuclear reaction compiled by Nuclear Reaction Data Centres Network coordinated by IAEA Nuclear Data Section. This list gives newly compiled data to EXFOR. *List consists of tables titled by target nuclide.*

Retrieval service is available at:

<http://www.jcprg.org/exfor/>

#### Quantity code

ALF	Alpha	FY	Fission product yield
AMP	Length or amplitude	INT	Cross section integral over incident energy
CHG	Fragment charge	KE	Kinetic energy
CS	Cross section	KER	Kerma factor
CSN	Differential with respect to number of particles	MLT	Multiplicity
CSP	Partial cross section	NQ	Nuclear quantity
CST	Temperature dependent cross section	NU	Nu
D3A	Triple differential $d\Omega_1/d\Omega_2/dE'$	NUD	Nu delayed
D3E	Triple differential $d\Omega/dE'_1/dE'_2$	NUF	Fragment neutrons
D4A	Quadruple diff. $d\Omega_1/d\Omega_2/dE'_1/dE'_2$	POL	Polarization
DA	Differential $d/d\Omega$	POD	Differential polarization
DAA	Double differential $d\Omega_1/d\Omega_2$	PY	Product yield (other than fission)
DAE	Double differential $d\Omega/dE'$	RI	Resonance integral
DAP	Partial differential $d/d\Omega$	RP	Resonance parameter
DAT	Temperature-dependent Legendre coefficient	RR	Reaction rate
DE	Differential $d/dE'$	SIF	Self indication
DEP	Energy spectrum for specific group	SPC	Gamma spectrum
DP	Diff. by linear momentum of outgoing part.	TSL	Thermal scattering
DT	Diff. by 4-momentum transfer squared	TT	Thick target yield
ETA	Eta	TTD	Differential thick target yield, $d/d\Omega$
EVL	Evaluation	TT	Partial thick target yield

#### Special codes in outgoing particle field

abs	Absorption	fus	Fusion	non	Nonelastic	ths	Thermal scattering
el	Elastic	inel	Inelastic	sct	Scattering	tot	Total
f	Fission	incl	Inclusive	tcc	Total charge changing		

#### Special codes in incident energy field

Fast	Fast reactor spectrum average	Maxw	Maxwellian spectrum average
Fiss	Fission spectrum average	Spont	Spontaneous (for fission)

**1 Hydrogen 2**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$p,n$	$^2\text{He}$	POD	1USALAS	3.0+08	7.9+08	Jour	PR/C,45,2564		Jun 92	M.W.Mcnaughton+	C0979

**3 Lithium 7**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$p,n$	$^7\text{Be}$	DAP	1USALTI	2.8+06	4.0+06	Jour	NIM/A,388,443		97	D.J.Desimone+	C0986
$d,n+\alpha$	$^4\text{He}$	DAA	1CANUBC	1.0+06		Jour	PL/B,43,289		Feb 73	J.C.P.Heggie+	T0053

**6 Carbon 12**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$p,\text{inel}$	$^{12}\text{C}$	DAP	1USAUSC	4.0+07		Jour	NIM,114,5		74	D.Ingham+	T0298

**6 Carbon 13**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$^3\text{He},\gamma$	$^{16}\text{O}$	DAP	1USAPEN	5.0+06	2.4+07	Thes	BROWN		90	K.D.Brown	C0977

**7 Nitrogen 14**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$p,\gamma$		RP	1USATNL	1.3+05		Jour	PR/C,66,022801		02	R.C.Runkle+	C1045

**7 Nitrogen 15**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$p,\gamma$	$^{16}\text{O}$	CSP	1USAPEN	1.0+07	1.7+07	Jour	PR/C,36,2235		Dec 87	D.P.Balamuth+	C0976
$p,\gamma$	$^{16}\text{O}$	DAP	1USAPEN	1.0+07	2.2+07	Jour	PR/C,36,2235		Dec 87	D.P.Balamuth+	C0976

**8                      Oxygen                      16**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$\alpha,0$		RP	1USAFSU	0.0+00		Jour	PR,160,791		Aug 67	M.K.Mehta+	T0246
$\alpha,el$	$^{16}\text{O}$	DA	1USAFSU	9.9+06	1.9+07	Jour	PR,160,791		Aug 67	M.K.Mehta+	T0246
$\alpha,inel$	$^{16}\text{O}$	DAP	1USAFSU	9.4+06	1.9+07	Jour	PR,160,791		Aug 67	M.K.Mehta+	T0246

**10                      Neon                      20**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$\alpha,0$		RP	1USAWIS	0.0+00		Jour	PR/C,45,2693		Jun 92	C.A.Davis	C0099
$\alpha,el$	$^{20}\text{Ne}$	DA	1USAFSU	1.6+07	1.8+07	Jour	PR/C,4,434		Aug 71	J.W.Frickey+	T0238
$\alpha,\gamma$	$^{24}\text{Mg}$	CSP	1USASTF	4.2+06	1.6+07	Jour	PR/C,11,1525		May 75	E.Kulhmann+	T0239
$\alpha,\gamma$	$^{24}\text{Mg}$	DAP	1USASTF	2.5+06	2.0+07	Jour	PR/C,11,1525		May 75	E.Kulhmann+	T0239
$\alpha,inel$	$^{20}\text{Ne}$	DAP	1USAFSU	1.6+07	1.8+07	Jour	PR/C,4,434		Aug 71	J.W.Frickey+	T0238
$\alpha,inel$	$^{20}\text{Ne}$	DAP	1USAWIS	8.4+06	1.1+07	Jour	PR/C,45,2693		Jun 92	C.A.Davis	C0099

**10                      Neon                      22**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$\alpha,\gamma$	$^{26}\text{Mg}$	CSP	1USASTF	5.6+06	1.2+07	Jour	PR/C,11,1525		May 75	E.Kulhmann+	T0239
$\alpha,\gamma$	$^{26}\text{Mg}$	DAP	1USASTF	4.7+06	1.6+07	Jour	PR/C,11,1525		May 75	E.Kulhmann+	T0239

**12                      Magnesium                      24**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$\alpha,\gamma$	$^{28}\text{Si}$	CSP	1USAWAU	4.2+06	1.4+07	Jour	PR/C,27,948		Mar 83	E.Kuhlmann+	T0247
$\alpha,\gamma$	$^{28}\text{Si}$	CSP	1USAANL	5.2+06	1.5+07	Jour	NP/A,108,180		68	L.Meyer-Schutzmeister+	T0255
$\alpha,\gamma$	$^{28}\text{Si}$	DAP	1USAANL	6.1+06	1.1+07	Jour	NP/A,108,180		68	L.Meyer-Schutzmeister+	T0255
$\alpha,inel$	$^{24}\text{Mg}$	DAP	1USAORL	2.8+07	4.0+07	Jour	NCL,21,195		78	Dahsuanfeng+	T0267

**12                      Magnesium                      26**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$\alpha,\gamma$	$^{30}\text{Si}$	CSP	1USAANL	4.0+06	1.3+07	Jour	NP/A,108,180		68	L.Meyer-Schutzmeister+	T0255

**13                      Aluminium                      27**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$d,non$		CS	1USAMRY	8.0+07		Jour	PR,19,372		Feb 79	J.R.Wu+	C1035

*d,p* incl CS 1USAMRY 8.0+07 Jour PR,19,372 Feb 79 J.R.Wu+ C1035

**14 Silicon 28**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation			Date	Author	Data #
				Min	Max		Ref	Vol	Page			
$\alpha,\gamma$	$^{32}\text{S}$	CSP	1USAANL	7.0+06	1.2+07	Jour	NP/A,108,180			68	L.Meyer-Schutzmeister+	T0255

**16 Sulphur 34**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation			Date	Author	Data #
				Min	Max		Ref	Vol	Page			
$\alpha,0$		RP	1USAFLA	0.0+00		Jour	NP/A,171,298			71	R.E.Clarke+	T0299

**19 Potassium 39**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation			Date	Author	Data #
				Min	Max		Ref	Vol	Page			
$p,\gamma$	$^{40}\text{Ca}$	DAP	1USAPEN	7.4+06	1.9+07	Thes	BROWN			90	K.D.Brown	C0977
$^3\text{He},d$	$^{40}\text{Ca}$	DAP	1USAPEN	1.4+07		Thes	BROWN			90	K.D.Brown	C0977

**20 Calcium 40**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation			Date	Author	Data #
				Min	Max		Ref	Vol	Page			
$p,\text{inel}$	$^{40}\text{Ca}$	DAP	1USAUSC	4.0+07		Jour	NIM,114,5			74	D.Ingham+	T0298

**26 Iron 56**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation			Date	Author	Data #
				Min	Max		Ref	Vol	Page			
$p,\text{inel}$	$^{56}\text{Fe}$	DAP	1USAUSC	4.0+07		Jour	NIM,114,5			74	D.Ingham+	T0298

**28 Nickel 58**

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation			Date	Author	Data #
				Min	Max		Ref	Vol	Page			
$p,\text{inel}$	$^{58}\text{Ni}$	DAP	1USAUSC	4.0+07		Jour	NIM,114,5			74	D.Ingham+	T0298
$d,\text{non}$	$^1\text{H}$	CS	1USAMRY	8.0+07		Jour	PR,19,372		Feb 79		J.R.Wu+	C1035
$d,p$	incl	CS	1USAMRY	8.0+07		Jour	PR,19,372		Feb 79		J.R.Wu+	C1035

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Copper

63

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>p,α</i>	<sup>60</sup> Ni	CS	1USALRL	6.2+06	1.1+07	Jour	PR,123,1818	61	J.Benveniste+	C0962
<i>p,el</i>	<sup>63</sup> Cu	CS	1USALRL	6.2+06	1.1+07	Jour	PR,123,1818	61	J.Benveniste+	C0962
<i>p,el</i>	<sup>63</sup> Cu	DA	1USALRL	1.2+07	7.3+06	Jour	PR,123,1818	61	J.Benveniste+	C0962

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Copper

65

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>p,α</i>	<sup>62</sup> Ni	CS	1USALRL	6.2+06	1.1+07	Jour	PR,123,1818	61	J.Benveniste+	C0962
<i>p,el</i>	<sup>65</sup> Cu	CS	1USALRL	6.2+06	1.1+07	Jour	PR,123,1818	61	J.Benveniste+	C0962
<i>p,el</i>	<sup>65</sup> Cu	DA	1USALRL	1.2+07	7.3+06	Jour	PR,123,1818	61	J.Benveniste+	C0962

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Rubidium

85

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>d,p</i>	<sup>86</sup> Rb	DAP	1USAFSU	1.2+07		Jour	PR,181,1618	May 69	J.W.Dawson+	C0973

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Rubidium

87

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>d,t</i>	<sup>86</sup> Rb	DAP	1USAFSU	1.2+07		Jour	PR,181,1618	May 69	J.W.Dawson+	C0973

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Zirconium

90

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>d,non</i>	<sup>1</sup> H	CS	1USAMRY	7.0+07		Jour	PR,19,372	Feb 79	J.R.Wu+	C1035
<i>d,p</i>	incl	CS	1USAMRY	7.0+07		Jour	PR,19,372	Feb 79	J.R.Wu+	C1035

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Lead

208

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>d,non</i>	<sup>1</sup> H	CS	1USAMRY	7.0+07		Jour	PR,19,372	Feb 79	J.R.Wu+	C1035
<i>d,p</i>	incl	CS	1USAMRY	7.0+07		Jour	PR,19,372	Feb 79	J.R.Wu+	C1035

## 90

## Thorium

232

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>d</i> ,non	<sup>1</sup> H	CS	1USAMRY	7.0+07		Jour	PR,19,372	Feb 79	J.R.Wu+	C1035
<i>d</i> , <i>p</i>	incl	CS	1USAMRY	7.0+07		Jour	PR,19,372	Feb 79	J.R.Wu+	C1035

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## Uranium

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>p</i> , <i>f</i>		CS	1USABNL	1.0+09	2.8+09	Jour	PR/B,139,1513	65	I.Dostrovsky+	C0236
<i>p</i> , <i>f</i>	<sup>86</sup> Rb	CS	1CANMCG	2.6+07	8.0+07	Jour	CJP,41,762	63	J.H.Davies+	T0297
<i>p</i> , <i>f</i>	<sup>97</sup> Zr	CS	1CANMCG	2.0+07	8.0+07	Jour	CJP,41,762	63	J.H.Davies+	T0297
<i>p</i> , <i>f</i>	<sup>95</sup> Nb	CS	1CANMCG	6.5+07	8.0+07	Jour	CJP,41,762	63	J.H.Davies+	T0297
<i>p</i> , <i>f</i>	<sup>96</sup> Nb	CS	1CANMCG	2.0+07	8.0+07	Jour	CJP,41,762	63	J.H.Davies+	T0297
<i>p</i> , <i>f</i>	<sup>97</sup> Nb	CS	1CANMCG	3.6+07	8.0+07	Jour	CJP,41,762	63	J.H.Davies+	T0297
<i>p</i> , <i>f</i>	<sup>138</sup> Xe	CS	1CANMCG	2.0+07	8.0+07	Jour	CJP,41,762	63	J.H.Davies+	T0297
<i>p</i> , <i>f</i>	<sup>130</sup> Cs	CS	1CANMCG	6.5+07	8.0+07	Jour	CJP,41,762	63	J.H.Davies+	T0297
<i>p</i> , <i>f</i>	<sup>132</sup> Cs	CS	1CANMCG	6.5+07	8.0+07	Jour	CJP,41,762	63	J.H.Davies+	T0297
<i>p</i> , <i>f</i>	<sup>134</sup> Cs	CS	1CANMCG	2.0+07	8.5+07	Jour	CJP,41,762	63	J.H.Davies+	T0297
<i>p</i> , <i>f</i>	<sup>136</sup> Cs	CS	1CANMCG	1.0+07	8.5+07	Jour	CJP,41,762	63	J.H.Davies+	T0297
<i>p</i> , <i>f</i>	<sup>137</sup> Cs	CS	1CANMCG	2.6+07	8.0+07	Jour	CJP,41,762	63	J.H.Davies+	T0297
<i>p</i> , <i>f</i>	<sup>138</sup> Cs	CS	1CANMCG	2.0+07	8.0+07	Jour	CJP,41,762	63	J.H.Davies+	T0297

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## Uranium

233

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>p</i> , <i>f</i>		CS	1USADKE	4.5+06	3.0+07	Jour	PR/C,10,231	Jul 74	J.R.Boyce+	T0296
<i>p</i> , <i>f</i>		DA	1USADKE	4.6+06	3.1+07	Jour	PR/C,10,231	Jul 74	J.R.Boyce+	T0296

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## Uranium

234

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>p</i> , <i>f</i>		CS	1USADKE	5.0+06	3.0+07	Jour	PR/C,10,231	Jul 74	J.R.Boyce+	T0296
<i>p</i> , <i>f</i>		DA	1USADKE	5.3+06	3.1+07	Jour	PR/C,10,231	Jul 74	J.R.Boyce+	T0296

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## Uranium

235

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>p</i> , <i>el</i>	<sup>235</sup> U	DA	1USADKE	1.4+07	2.5+07	Jour	PR/C,10,231	Jul 74	J.R.Boyce+	T0296
<i>p</i> , <i>f</i>		CS	1USADKE	5.2+06	3.0+07	Jour	PR/C,10,231	Jul 74	J.R.Boyce+	T0296
<i>p</i> , <i>f</i>		DA	1USADKE	5.4+06	3.1+07	Jour	PR/C,10,231	Jul 74	J.R.Boyce+	T0296

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Uranium

236

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>p,el</i>	<sup>236</sup> U	DA	1USADKE	1.8+07	2.0+07	Jour	PR/C,10,231	Jul 74	J.R.Boyce+	T0296
<i>p,f</i>		CS	1USADKE	5.5+06	3.1+07	Jour	PR/C,10,231	Jul 74	J.R.Boyce+	T0296
<i>p,f</i>		DA	1USADKE	5.9+06	3.1+07	Jour	PR/C,10,231	Jul 74	J.R.Boyce+	T0296

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Uranium

238

Reaction	Product	Quantity	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>p,f</i>		CS	1USADKE	5.5+06	3.1+07	Jour	PR/C,10,231	Jul 74	J.R.Boyce+	T0296
<i>p,f</i>		DA	1USADKE	5.4+06	3.2+07	Jour	PR/C,10,231	Jul 74	J.R.Boyce+	T0296