Creation and Revision of Entries for Thermal Neutron Constants

(N. Otsuka, 2016-09-21, Memo 4C-3/405)

I reviewed again the experimental data adopted by Axton's thermal neutron constant evaluation (E.J. Axton, GE/PH/01/86, 1986), and summarized data for additional compilation (**Table 1**) and corrections (**Table 2**, added to the Feedback List).

Some general remarks on compilation of thermal neutron data:

1. Add `DERIV` in REACTION SF9 for a 2200 m/s value obtained by interpolation or extrapolation of point-wise values

2. Code the temperature of the neutron field under `KT-K` etc. instead of `EN-DUMMY=0.0253 eV` when a Maxwellian averaged cross section at a temperature far from the room temperature is compiled.

3. Describe the Westcott's g-factor when it is assumed to derive the 2200 m/s value compiled.

4. Describe the fission neutron mean neutron energy when it is assumed in neutron detector efficiency calibration for fission neutron multiplicity measurement.

5. Describe the half-life of the sample material when it is assumed in quantification of the number of atoms (e.g., by α spectrometry).

Table 1: Data for additional compilation (*There might be more data in these references for additional compilation.*)

Author	Reference	EXFOR #	Lab.	Quant.	Value	Remark
R.L.G. Keith+	J,JNE,22,477,1968	23309	2UK ALD	σ_{f3}	534.6(53) b	Preliminary data in R,EANDC(UK)-92. Under compilation.
				σ_{f5}	582.9(64) b	
				σ_{f9}	742.0(67) b	
R. Vidal+	C,70HELSINKI,1,295,1970	20552	2FR SAC	$<\sigma_{f3}>/<\sigma_{f5}>$	0.931(5)	
				σ_{f3}/σ_{f5}	0.914(5)	
F.W. Cornish	R,NRDC-129,1960	23310	2UK HAR	$\sigma_{\gamma5}/\sigma_{f5}$	0.194(8)	Under compilation
F. Lisman+	R,IN-1178,6,1968	(NNDC)	1USAMTR	$\sigma_{\gamma5}/\sigma_{f5}$	0.171(3)	FY in EXFOR 13270.
D.R. deBoisblanc+	J,ANS,4,270,1961	(NNDC)	1USAMTR	$(\eta_3)/(\eta_5)$	1.115(8)	Missing in CINDA.
M.J. Cabell+	R,AERE-R-4946,1965= TNCC(UK)-77,1960	23311	2UK HAR	η_3/η_5	1.102(14)	Preliminary data in 58GENEVA,16,34,1958, AERE-R/R-2457. Under compilation
				η_9/η_5	1.006(11)	
P.A. Egelstaff	R,AERE-NP/R-2104,1,1957	21179.009	2UK HAR	σ_{t5}	724(15) b	
J.R. Smith	R,EPRI-NP-3436,(4),1984	13019	1USAMTR	σ_{t1}	1395(20) b	
J.W. Boldeman	C,77NBS,,182,1977	31761.003	3AULAUA	ν_{52}	3.746(16)	
H. Conde	J,AF,29,293,1965	20025.003	2SWDFOA	ν_5/ν_{52}	0.6400(53)	
M.J. Cabell	R,AERE-R-5874,1968	21410	2UK HAR	$[\sigma_{a,9}]/[\sigma_{\gamma,9}]$	3.269(89)	

$<\dots>$ T=20 deg neutron field, $(\dots)$ T=25 deg neutron field, $[\dots]$ T=116 deg neutron field

f: fission, γ: capture, t: total

3: ^{233}U, 5: ^{235}U, 9: ^{239}Pu, 1: ^{241}Pu, 52: ^{252}Cf

Table 2: Necessary corrections to existing entries

EXFOR #	Keyword	Comments
10941.001	REFERENCE	Add R,EPRI-NP-3436,(1),1984 as the main reference (Same value given).
12335.001	REFERENCE	Add J,NSE,16,245,1963 as the main reference. Also R,ORNL-3320 -> P,ORNL-3176 (or delete).
12335.002	REACTION	SF8: Delete MXW.
12356.002	Data	EN-DUMMY=2.53E-08 MeV -> KT-K=27 deg-C; ERR-S: 0.14E-03 -> 0.14%
12356.009	Data	EN-DUMMY=2.53E-08 MeV -> KT-K=27 deg-C
12356.009	Heading	DATA-ERR: -> ERR-S with NO-DIM -> PER-CENT
12356.010	Data	EN-DUMMY=2.43E-08 MeV -> KT-K=27 deg-C
12356.010	Heading	DATA-ERR: -> ERR-S with NO-DIM -> PER-CENT
12529.005	REACTION	SF9: Add DERIV (c.f. ANALYSIS)
12318.001	REFERENCE	Add R,EPRI-NP-3436,(2),1984 (final absolute values given)
12318.003.1	REACTION	SF1: 92-U-235 -> 92-U-233 at 0.057 eV.
12554.001	REFERENCE	Add R,EPRI-NP-3436,(2),1984 (final absolute value given without uncertainty)
13018.001	REFERENCE	Add R,EPRI-NP-3436,(3),1984 (final values given without uncertainty)
13019.001	REFERENCE	Add R,EPRI-NP-3436,(4),1984 (final values given)
20025.001	REFERENCE	65SALZBURG: Thermal value -> Preliminary thermal value
20025.003	REACTION	SF9: Add DERIV (c.f. ANALYSIS)
20112.003	REACTION	SF9: Add DERIV(c.f. ANALYSIS)
	STATUS	Use (SPSDD,20025003). See Table 1 of 4C-3/405 about 20025.003.
	Data	Add the superseded value 2.417+/-0.015 in C,65SALZBURG,2,57,1965 to clarify what was superseded.
20189.002	Data	Move the interpolated thermal value with FLAG=1 to 003 with SF9=DERIV.
21179.006	STATUS	Add (SPSDD,21179009). See Table 1 of 4C-3/405 about 21179.009.
21410.002 to 21410.011	Data	`EN-DUMMY= 2.5300E-02 eV -> KT-K=116+/-9 deg-C`
21410.002 to 21410.010	REACTION	SF8: MXW -> SPA (epithermal index is given)
21410.011	REACTION	SF8: Add SPA.
21454.002 21454.003 21454.006	REACTION	// -> /
31761.002	STATUS	Add (SPSDD,31761003). See Table 1 of 4C-3/405 about 31761.003.
40651.001	Common	Move ERR-S=1.2% to 002 replacing DATA-ERR=8 b?
40651.002	REACTION	SF8: Delete MXW.