Coping of Isomeric Cross Sections

(O. Schwerer, 2019-03-12, Memo CP-C/467)

Memo CP-D/783 Rev.2 gave a revised summary of the coding of independent and cumulative data, and its content was included in the latest version of LEXFOR.

Today we propose a small change to these rules, concerning the coding of a certain type of isomeric cross sections populating the ground state.

For the production of the ground state, the memo introduced the distinction between the case where no decay from the metastable state to the ground state exists (case “a=0” in the memo), and the case where the isomeric transition exists but was excluded from the data by the authors (case “a excl.” in the memo).

REACTION SF4 – SF6 would then be

(1) ….Z-S-A-G,,SIG for a=0 and
(2) ….Z-S-A-G,M-,SIG for a excl.

We now propose to use only one coding for both cases, namely (1) (without SF5=M-), because

- the coding Z-S-A-G,M-,SIG can be confusing. Its difference to Z-S-A-G,,SIG is difficult to understand for users because in the literature people make normally no difference between "a excl." and "a=0"

- when the variable product nucleus formalism is used (with REACTION SF4 = ELEM/MASS), an isomeric cross section for the ground state is designated in the data table with ISOMER = 0. There is no way to distinguish the cases -G,,SIG and -G,M-,SIG, which is a disturbing ambiguity (sometimes the data for a certain product are to be moved to a separate subentry, and then the correct REACTION code will be undefined)

- similarly, when isomeric ratios are given implicitly, the code ...-M/G,,SIG/RAT corresponds to two different reaction ratios:

(Z-S-A(N,X)Z'-S'-A'-M/G,,SIG/RAT)
can stand for

((Z-S-A(N,X)Z'-S'-A'-M,,SIG)/(Z-S-A(N,X)Z'-S'-A'-G,,SIG))

or for

((Z-S-A(N,X)Z'-S'-A'-M,,SIG)/(Z-S-A(N,X)Z'-S'-A'-G,M-,SIG))

This can be another source of confusion for users.

Another, practical reason is that the addition of SF5 = M- in all subentries where it would apply according to CP-D/783 Rev.2 was so far done only for a minority of the cases. Using the same coding for both types of ground state cross sections will save us from making those retransmissions.

Proposed changes to LEXFOR "Independent and Cumulative Data"

1. Change the table on page I.5:

Branch Code	Definition
IND	Feeding via radioactive decay exists, but excluded experimentally. To be used only with process codes X or F. IND may be used only if CUM may also occur with the same reaction (i.e. the same SF1 – SF4). If only independent channels are possible, IND is not coded. ~~Use M- instead of IND when feeding via radioactive decay of another nuclide does not exist.~~
CUM	Data given includes the feeding via radioactive decay of another nuclide (and via isomeric transition when it exists). To be used only with process codes X or F.
(CUM)	Uncertain if the formation via radioactive decay (and isomeric transition when it exists) is included.
M+	Data given for an isomeric state includes formation by partial feeding via isomeric transition . To be used only with the isomeric flag -G in SF4[1]. Use CUM instead of M+ when feeding via decay of another nuclide is also included. (See also **Isomeric States**).
CUM/M-	Data given for the cumulative yield to an isomeric state excludes formation by feeding via isomeric transition from metastable states of higher excitation energy.
(M)	Uncertain if the formation by partial feeding via isomeric transition is included. To be used only with the isomeric flag -G in SF4[1]. Use (CUM) instead of (M) when also uncertain if feeding via radioactive decay of another nuclide is included.

2. Change the table on page I.6:

	No *a* *a*=1	*a*=0	*a* excl.	0<*a*<1	*a*=?
No *b* b=0	**Z-S-A**	Z-S-A-G	Z-S-A-G	Z-S-A-G,M+	Z-S-A-G,(M)
b excl.	Z-S-A,IND	Z-S-A-G,IND	Z-S-A-G,IND	Z-S-A-G,IND/M+	Z-S-A-G,IND/(M)
0<*b*≤1	Z-S-A,CUM	Z-S-A-G,CUM	Z-S-A-G,CUM/M-	Z-S-A-G,CUM	Z-S-A-G,CUM/(M)
b=?	Z-S-A,(CUM)	Z-S-A-G,(CUM)	Z-S-A-G,(CUM)/M-	Z-S-A-G,(CUM)/M+	Z-S-A-G,(CUM)

[1] Or another isomeric state code when the possible contribution of a higher state is considered, e.g. -M1 when M2 exists.

Concluding remark

We do understand that, in order to remove *all* inconsistencies in the REACTION coding of the different data types described in the LEXFOR page “Independent and Cumulative Data”, the over-all deletion of SF5=IND would be the most consistent solution. This would, however, have many more far-reaching consequences and would probably still not be well received by certain user groups. If, on the other hand, IND is abolished with the exception of certain data types, we will still have inconsistencies and create some new ones. Therefore we believe that the present proposal is a practicable compromise.