**Nuclear Data Section**

**International Atomic Energy Agency**

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**Memo CP-D/1116**

**Date:** 30 August 2024

**To:** Distribution

**From:** N. Otsuka

**Subject: REACTION codes of 89Y(p,n)89Zr and 89Y(d,2n)89Zr datasets**

Motivated by a question on the metastable state contribution in the excitation function of 89Y(p,n)89Zr (a candidate of positron emitter production route) displayed on the NDS website, I looked into the EXFOR situation.

The half-life of the metastable state (m.s.) 89mZr (4 min) is extremely shorter than the half-life of the ground state (g.s.) 89gZr (78 h). Therefore, we expect the cross sections measured by the g.s. activity is for 89gZr (78 h) production and ~94% of 89mZr (4 min) production unless separate measurement of the m.s. activity is done. I see only a part of experiments report the real total cross sections (by measuring both g.s. and m.s. activities or by neutron detection). I reviewed the situation in EXFOR for both (p,n) and (d,2n) reactions, and summarized my suggestions in the table appended to this memo.

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**Distribution:**

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**Cross sections in EXFOR for 89Y(p,n)89g+mZr and 89Y(d,2n)89g+mZr (as of 2024-08-29)**

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| --- | --- | --- | --- |
| **Dataset ID** | **REACTION (current)** | **Suggested corrections** | **Remark** |
| A0347.039 | 39-Y-89(D,2N)40-ZR-89,,SIG | (no suggestion) | m.s. cross section in A0347.038 |
| A0510.185 | 39-Y-89(P,N)40-ZR-89,,SIG | Add -G in SF4 and (M) in SF5 | Famous report in Russian by Levkovskii. |
| A0931.004 | 39-Y-89(P,N)40-ZR-89,,SIG | Add -G in SF4 and M+ in SF5. | Absence of correct mentioned by the authors. |
| C0774.002 | 39-Y-89(P,N)40-ZR-89,,SIG | (no suggestion) | Neutron detection by BF3 |
| C1299.002 | 39-Y-89(P,N)40-ZR-89,,SIG | Add -G in SF4 and (M) in SF5 | No discussion about IT contribution |
| D0029.002 | 39-Y-89(P,N)40-ZR-89,,SIG | Add -G in SF4 and (M) in SF5 | No discussion about IT contribution |
| D0584.003 | 39-Y-89(P,N)40-ZR-89,,SIG | Add -G in SF4 and M+ in SF5. | Declared as cumulative by the authors. |
| D0629.010 | 39-Y-89(P,N)40-ZR-89,,SIG | Add -G in SF4 and M+ in SF5. | Declared as cumulative by the authors. |
| D4059.012 | 39-Y-89(D,2N)40-ZR-89,,SIG | Add -G in SF4 and (M) in SF5 | No discussion about IT contribution |
| D6178.004 | 39-Y-89(P,N)40-ZR-89,,SIG | (no suggestion) | g.s. and m.s. cross sections in D6178.002 and 003. |
| E2653.002 | 39-Y-89(D,2N)40-ZR-89,,SIG | Add -G in SF4 and M+ in SF5. | Declared as cumulative by the authors. |
| O2103.005 | 39-Y-89(P,N)40-ZR-89,,SIG | Add -G in SF4 and (M) in SF5 | No discussion about IT contribution (though they report calculated isomeric ratios.) |
| O2453.002 | 39-Y-89(D,2N)40-ZR-89,,SIG | Add -G in SF4 and M+ in SF5.  | Declared as cumulative by the authors. |
| S0040.002 | 39-Y-89(P,N)40-ZR-89,,SIG | Add DERIV in SF9. | Corrected with isomeric ratio measured by P0012. |
| T0130.013 | 39-Y-89(P,N)40-ZR-89,,SIG | (no suggestion) | Neutron detection by boron long counter |