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# Deuteron-induced reaction cross sections for 93Zr up to 200 MeV

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Description of the deuteron-nucleus interaction is still a challenge for the basic research, while the accurate activation cross sections are highly requested by several on-going strategic research projects (ITER, IFMIF, SPIRAL-2). Actually, evaluation of the deuteron-induced activation data for IFMIF has pointed out a ratio of ~70 for the deuteron- and neutron-induced activities over the same decay times, showing the great importance of deuteron-induced reactions [1]. However, in opposition to the case of neutrons, the systematic of deuteron activation cross sections is yet modest.
While recent advancements in deuteron reaction modeling in the TALYS code [2,3] are taken into account to provide more reliable data, to be reviewed and integrated step by step in the future [4], current discrepancies between experimental and calculated data follow the incomplete theoretical frame of deuteron interactions requesting, besides pre-equilibrium emission (PE) and fully equilibrated compound nucleus (CN) decay, consistent inclusion of breakup mechanism (BU) and direct reactions (DR) contributions. Furthermore, the consideration of the deuteron BU has to take into account two opposite effects, namely the important BU leakage of initial flux as well as the BF enhancement brought by the BU-nucleon interactions with the target nucleus (e.g., [3,5]). Thus, an extended analysis of the deuteron interaction with the target nuclei common in the alloys of candidate materials for ITER and IFMIF installations already concerned the stable isotopes of Al, Cr, Mn, Fe, Co, Ni, Zr, Nb, and Mo for deuteron energies ≤60 MeV ([3] and Refs. therein).
An amazing opportunity to extend the incident energy range of the above-mentioned analyses is provided by recent experimental studies which were performed for deuteron-induced reactions by inverse-kinematics studies using radioactive ion (RI) beams across 50–210 MeV ([6] and Refs. therein). Thus, the most recent 93Zr+d production cross sections of Nb and Zr isotopes at ~50 MeV are quite well reproduced by TALYS, showing qualitative improvement [6] with the recent BU model [3]. However, the case is different for Y-isotope production, where the alpha emission channels for Y-isotope production are dominant but still underestimated up to a factor of 3. It is the object of this work to continue the efforts to better describe these new results and improve models of deuteron-breakup mechanisms across the widest possible energy range. We have used in this respect the experience leading already to the suitable account of all reaction cross sections induced by deuteron on 93Nb [7] and 90-92,94,96Zr [8] within the energy range ≤60 MeV.

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