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Production cross-section of ^{53}Mn via different reaction channels

ABSTRACT. Long-lived activation products produced during the operation of fusion reactors may engender long-term waste disposal problems along with radiation damage. ^{53}Mn ($t_{1/2}$ = 3.7 Myear) is a long-lived radionuclide produced inside a fusion reactor via different pathways. Production cross-sections of ^{53}Mn through neutron-induced reaction on stable nuclides via ^{54}Fe(n,np)^{53}Mn, ^{54}Fe(n,2n)^{53}Fe(β^+)^{53}Mn, ^{54}Fe(n,d)^{53}Mn reactions, on unstable nuclei via ^{54}Mn(n,2n)^{53}Mn, ^{55}Fe(n,t)^{53}Mn and ^{57}Co(n,nα)^{53}Mn reactions, and by sequential charged particle-induced reactions ^{50}V(α,n)^{53}Mn, ^{53}Cr(p,n)^{53}Mn, ^{52}Cr(d,n)^{53}Mn have been calculated in an energy range from threshold to 20 MeV using TALYS-1.9. Sequential charged particle-induced reactions make a significant contribution to the production of ^{53}Mn inside a fusion reactor. Outgoing particle (ejectile) energy spectra show the presence of a high energy tail due to a pre-equilibrium contribution to charged particle reactions. Existing experimental data for the reactions cosidered are scarce and contradictory in the EXFOR data library, which is why these reactions are studied in the present work. Nuclear data related to the production of ^{53}Mn via different reactions are briefly discussed.

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