Photonuclear reactions on cobalt and yttrium

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Relative yields of photonuclear reactions on 59Co and 89Y were measured with the beam of bremsstrahlung γ-radiation at the energies of 40-130 MeV. The experiments were performed with the beam from the electron linear accelerator LINAC-200 using the γ-activation techniques. The theoretical relative yields were calculated by using the computer code TALYS-2.0 [1] with different models of the strength function.

Obtained relative yields of the 59Co(γ,xn; x=1-4)58-55Co, 59Co(γ, 2pxn; x=1-5)56-52Mn, and 59Co(γ, 3pxn; x=5-7)51,49Cr reactions along with the literature data are found to be in good agreement with the simulated values [2]. The relative yields for reactions producing 54,52g,52mMn and 49,51Cr are not constantly increasing functions. This is due to the fact that in the initial energy region the main channels for the formation of the 54,52g,52mMn and 49,51Cr isotopes are reactions with the emission of an α-particle. Near the energies of reaction threshold, the 59Co(γ, xn2p)54,52g,52mMn and 59Co(γ, xn3p)49,51Cr reactions are accompanied with the release of alpha-particles and thus it cross sections decrease. The experimentally obtained isomeric ratio for the pairs 52m,gMn at the bremsstrahlung end-point energies of 80–130 MeV complement the missing experimental data in the literature.

Experimental yields of the 89Y(γ,xn; x = 1–5)84m,85g,85m,86g,86m,87g,87mY, 89Y(γ,pxn; x = 1–5)83m+g,87mSr and 89Y(γ, αxn; x = 1–4)81m+g,82m,83,84g,84mRb reactions were compared to theoretical values predicted with TALYS-2.0. The relative yields for processes generating 81m+g,82m,83,84g,84mRb do not show a consistent increase. In the initial energy range, the principal routes for forming the 81m+g,82m,83,84g,84mRb isotopes involve processes that produce α-particles, resulting in this variety. Near the reaction threshold energies, the 81m+g,82m,83,84g,84mRb reactions produce α-particles, decreasing their cross section. The experimentally obtained isomeric ratio for the pairs 87m,gY, 86m,gY, 85m,gY and 84m,gRb at the bremsstrahlung end-point energies of 40–130 MeV complement the missing experimental data in the literatures.

REFERENCES

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