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Investigation of reactions with ^{50}Ti and ^{54}Cr for the synthesis of new elements

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The ^{238}U(^{54}Cr,4n)^{288}Lv and ^{242}Pu(^{50}Ti,3-4n)^{288,289}Lv reactions have been studied at the gas-filled separator DGFRS-2 at the SHE Factory at Flerov Laboratory of Nuclear Reactions, Joint Institute for Nuclear Research. Three new isotopes were discovered: two α-decaying nuclei ^{288}Lv with α-particle energy E = 11.08 MeV and half-life $T_{1/2}$ = 2.0 ms, ^{289}Lv with E = 10.90 MeV, $T_{1/2}$ = 2.4 ms, and granddaughter of ^{288}Lv, spontaneously fissioning ^{280}Cn with $T_{1/2}$ = 10 μs, which was observed after the first registration of α decay of ^{284}Fl with E = 10.57 MeV. Besides, for the first time we reliably registered the *pxn* channel of the ^{242}Pu + ^{50}Ti reaction, which was not evidently observed in the ^{48}Ca-induced reactions in previous studies. The cross sections of the 3n and 4n channels of the ^{242}Pu + ^{50}Ti reaction of $0.32^{+0.34}_{-0.18}$ pb and $0.22^{+0.27}_{-0.15}$ pb, respectively, were measured at excitation energy of the ^{292}Lv compound nucleus E^* = 41 MeV. The cross section of the 4n-evaporation channel of the ^{238}U + ^{54}Cr reaction, leading to the same compound nucleus, at E^* = 42 MeV of 36^{+46}_{-24} fb turned out to be approximately 15 times lower than the total cross section of the ^{242}Pu + ^{50}Ti reaction at close excitation energy. Thus, for the first time, it was convincingly proved in an experiment that the reactions of isotopes of actinide elements with ^{50}Ti are an order of magnitude preferable to reactions with ^{54}Cr for the synthesis of new elements 119 and 120.

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