

Exploring the superheavy nuclei using ^{50}Ti and ^{54}Cr beams

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The $^{238}\text{U}(^{54}\text{Cr},4n)^{288}\text{Lv}$ and $^{242}\text{Pu}(^{50}\text{Ti},3-4n)^{288,289}\text{Lv}$ reactions were studied using the gas-filled separator DGFRS-2. The $^{242}\text{Pu}+^{50}\text{Ti}$ experiment was carried out at the excitation energies of the compound nucleus ^{292}Lv $E^* = 41$ and 36 MeV. During the experiments, three new isotopes were discovered: two α -decaying nuclei ^{288}Lv and ^{289}Lv , as well as spontaneously fissioning ^{280}Cn , observed following the first detection of the α decay of ^{284}Fl . A decline in E^* led to a drop of the total fusion-evaporation cross section by about an order of magnitude, from 540^{+410}_{-250} fb to 54^{+141}_{-46} fb. Besides, for the first time we have registered the pxn channel of the $^{242}\text{Pu}+^{50}\text{Ti}$ reaction which was not evidently observed in the ^{48}Ca -induced reactions in previous studies.

The cross section of the $4n$ -channel of the $^{238}\text{U} + ^{54}\text{Cr}$ reaction [1], leading to the same compound nucleus, was found to be approximately 15 times lower than the total cross section of the $^{242}\text{Pu} + ^{50}\text{Ti}$ reaction [2] at similar excitation energy. This proves that reactions of actinide isotopes with ^{50}Ti ions are more preferable to those with ^{54}Cr by an order of magnitude for the synthesis of new elements 119 and 120.

References

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2. Yu. Ts. Oganessian [et al.], Phys. Rev. C **113**, 014614 (2026).