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Relations of isotope yields as an indicator of neutron fluxes in artificial rapid process

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The creation of heavy isotopes under extremal pulsed neutron fluences (of 10^{24} n/cm^2 units) of artificial nucleosynthesis is investigated by means of the dynamical model taking into account the temperature decrease at the matter expansion. The first time the creation of isotopes with neutron excess up to mass A = 255 was obtained and discovered in the Mike experiment [1]. An intensive (n,γ)-activation of the irradiated 238U target ensures the creation of neutron-rich isotopes up to 257Fm. The rapid process is the consistent multiple neutron capture in the target (manufactured from the 238U or more heavy/mixture isotopes as 232Th, 237Np, 238U, 242Pu, 243Am). Creation of transuranium isotopes were investigated during the Plowshare program and some next nuclear tests: Anacostia, Kennebec, Par, Barbel, Tweed, Cyclamen, Kankakee, Vulcan and Hutch [2-5]. In the realized model of the nucleosynthesis (realized during the short time exposition - ˜10^{-6} s) it were considered the sequential (n,γ)-neutron captures by mono isotope 238U target and binary (238U + 239Pu)-variant for case of 239Pu injection [6,7]. The model includes the temperature decrease during the adiabatic expansion with index γ = 1.5 at the initial temperature ˜20 keV and linear velocity ˜190 km/s. Here we simulated the isotope yields for Mike, Anacostia, Barbel, Par, Vulcan and Kankakee experiments. The obtained results indicated on the approximately linear dependence for relations of the isotope yields relative to the obtained neutron fluence [8]. In the work we considered the pairs of neighboring isotopes with atomic masses A=245 and 244, A=246 and 245, A=247 and 246. The relation 246/245 (i.e., yields with masses A=246 and 245) depending on the fluences is the most strong demonstrator of the linear dependence. The most strong confirmation of the roughly linear dependence was obtained for the pure 238U target.

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