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The Signature of Neutron Fluences of the Artificial Pulse Nucleosynthesis

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An extreme high intensive neutron pulses ensure the conditions for pulse
nucleosynthesis realized in nature (at neutron concentration >10E+19 cm-3): at different mechanism of supernova explosions, in very massive stars, at merging and destroying of neutron stars). In the artificial condition the nucleosynthesis can occur in the close zone of nuclear/thermonuclear explosions where the neutron fluxes reach the units of 10E+24 cm-2 during the short pulse ~10E-6 s (pr- promt rapid process). The purpose of executed experiments on nucleosynthesis were production of transuranic elements by multiple (n,?)-captures in the irradiated target (manufactured from the 238U or more heavy/mixture isotopes as 232Th, 237Np, 238U, 242Pu and 243Am). The first time the creation of isotopes with neutron excess up to mass A = 255 was obtained and discovered in the Mike experiment [1]. During the Plowshare scientific program and some next USA nuclear tests (as Anacostia, Kennebec, Par, Barbel, Tweed, Cyclamen, Kankakee, Vulcan and Hutch) the transuranium isotopes up to A=257 was registered [2-4].
Basing on the proposed ABM-model it was simulated the transuranium isotope yields for five large scale pulse experiments (Mike, Anacostia, Barbel, Par and Vulcan) for creation of uranium isotopes up to A=257. The model target irradiated by sequential (n,?)-neutron captures is the mixture of 238U (main isotope) with admixture of the 239Pu injected into the plasma ball [5,6]. The model includes the elements of the dynamics with temperature decrease down to ~2 keV and expansion of the matter with linear velocity ~190 km/s. The obtained results indicated on the roughly linear dependence of the isotope Y-yield relations from the neutron fluence [7]. It were considered the next 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 analysis of transuranic isotope yields and them relation can be sensitive signature of the fluences realized in artificial nucleosynthesis.
[1] Dorn D.W. Phys Rev 1962;126:693
[2] Hoff R.W., Dorn DW. Nucl Sci Eng 1964;18:110.
[3] Dorn D.W, Hoff RW. Phys Rev Lett 1965;14:440.
[4] Los Alamos Radiochemistry Group. Phys Rev Lett 1965;14:962.
[5] Lutostansky Yu.S, Lyashuk V.I, Panov I.V. Bull Russ Acad Sci: Phys 2010;75:533.
[6] Lyashuk V.I. Bull Russ Acad Sci: Phys 2012;76:1182–6.
[7] Lyashuk V.I., Results in Physics 2024; 56:107234.

Section

Experimental and theoretical studies of nuclear reactions

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