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Ternary fission of actinides induced by thermal neutrons with light particles emission

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In [1-3] the virtual mechanism of ternary fission of the compound nucleus (A, Z), formed by the capture of the thermal neutron by target-nucleus $(A-1, Z)$ as the two-stage process was suggested. At the first stage light particle $(A-A_{LP}, Z-Z_{LP})$ with kinetic energy close to the Coulomb barrier height is emitted from the nucleus (A, Z) with the forming of the virtual state of the intermediate nucleus having internal energy lower than its ground state energy and undergoing binary fission at the second stage. The yield N_{LP} of the light particle and the energy distribution $W(T_{LP})$ related to one act of the binary fission are defined as [1-3]

$N_{LP} = \int W(T_{LP})dT_{LP} = \frac{\Gamma_{LPf}}{\Gamma_f^A}; W(T_{LP}) = \frac{1}{2\pi}\frac{(\Gamma_{LP}^A)^{(0)}}{(Q_{LP}^A+|B_n|-T_{LP})^2} = \omega_{LP}\frac{\hbar c\sqrt{2T_{LP}}}{2R_{neck}\sqrt{\mu c^2}}P(T_{LP})$

where Γ_{LPf} and Γ_f^A are the widths of the ternary and binary fission of compound nucleus (A, Z), correspondingly, $(\Gamma_{LP}^A)^{(0)}$ is the width of the virtual decay of the nucleus (A, Z) with light particle emission from the deformed transition fission state corresponding to the configuration (0) of these nuclei with the neck radius R_{neck} between two fission prefragments, Q_{LP}^A is the heat of the decay of the nucleus (A, Z) with light particle emission, B_n is neutron binding energy in (A, Z), $P(T_{LP})$ is light particle penetrability factor of the Coulomb barrier formed by the sum of the non-spherical nuclear and Coulomb potentials of the light particle interaction with nucleus $(A-A_{LP}, Z-Z_{LP})$, ω_{LP} is the probability of light particle formation in the neck of the nucleus (A, Z), μ is the reduced mass of light particle and nucleus $(A-A_{LP}, Z-Z_{LP})$. Using the experimental energy distributions $W(T_{LP})$ [4 - 6], the estimations of the R_{neck} [7] and taking into account that penetrability factor $P(T_{LP}) \approx 1$ at the maximal energies of the emitted light particles $(T_{LP})_{max}$ the estimations of the probability of the light particle formation were obtained for the target-nuclei ^{233}U, ^{235}U, ^{249}Cm, ^{251}Cf, in fission induced by thermal neutrons.

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