ACCOMPANIED BY ALPHA-PARTICLES TERNARY FISSION OF ACTINIDES INDUCED BY THERMAL NEUTRONS

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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 long-ranged α-particle with kinetic energy T_α close to the Coulomb barrier height is emitted from the nucleus (*A*, *Z*) with the forming of the virtual state of the intermediate nucleus (*A*–4, *Z*–2) with internal energy lower than its ground state energy and undergoing binary fission at the second stage. The yield N_α of the α-particles and the energy distribution $W_{\alpha f}(T_\alpha)$ related to one act of the binary fission are defined as [1-3]

$$N_\alpha = \int W_{\alpha f}\left(T_\alpha\right) dT_\alpha = \frac{\Gamma_{\alpha f}}{\Gamma_f^A}, \quad (1)$$

$$W_{\alpha f}\left(T_\alpha\right) = \frac{1}{2\pi} \frac{\left(\Gamma_\alpha^A\left(T_\alpha\right)\right)^0}{\left(Q_\alpha^A + \left|B_n\right| - T_\alpha\right)^2} = \omega_\alpha \frac{\hbar c\sqrt{2T_\alpha}}{2R_{\text{neck}}\sqrt{\mu c^2}} P\left(T_\alpha\right), \quad (2)$$

where $\Gamma_{\alpha f}$ and Γ_f^A is the widths of the ternary and binary fission of compound nucleus (*A*, *Z*), consequently, $\left(\Gamma_\alpha^A(T_\alpha)\right)^0$ is the width of the virtual α-decay of the nucleus (*A*, *Z*) 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_α is the heat of the true α-decay of the nucleus (*A*, *Z*), B_n is neutron binding energy in (*A*, *Z*), $P(T_\alpha)$ is α-particle penetrability factor of the Coulomb barrier formed by the sum of the non-spherical nuclear $V_{\text{n}}\left(\vec{r}\right)$ and Coulomb $V_{\text{c}}\left(\vec{r}\right)$ potentials of the α-particle interaction with nucleus (*A*–4, *Z*–2), ω_α is the probability of α-particle formation in the nucleus (*A*, *Z*), μ is the reduced mass of α-particle and nucleus (*A*–4, *Z*–2). Using the experimental energy distributions $W_{\alpha f}$ (T_α) [4-6] the estimations of the R_{neck} from (2) were obtained, taking into account that $P(T_\alpha) \approx 1$ at the maximal energies of the emitted α-particles T_α. The values of the neck radius R_{neck} are 2.37 fm for target-nuclei U^{233}, 2.66 fm for ^{235}U, 2.87 fm for ^{241}Pu and 2.54 for ^{251}Cf in fission induced by thermal neutrons and are in good agreement with R_{neck} from [7] and demonstrates that α-particle in ternary fission is escapes from the compound nucleus neck.

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