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Role of Surface energy coefficient in α decay of residual nucleus 214U formed via 36Ar Induced Reaction

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The α decay is a fundamental nuclear process where an unstable heavy nucleus emits an α particle, along with a complementary daughter nucleus. The comprehensive understanding of this dominant radioactive decay imparts useful insights for better understanding of nuclear stability and related aspects [1].
In this study, we have investigated the α decay of residual nucleus 214U formed in the fusion evaporation reaction 182W(36Ar,4n)214U reaction, using the Dynamical Cluster Decay Model (T ≠ 0) [2]. We have employed 13 sets of surface energy coefficients (γ0) and corresponding surface asymmetry (Ks) [3] on the alpha decay characteristics of ^{214}U.
Our results show that the calculated α-decay half-lives with different sets of surface energy coefficient (γ0) and surface symmetry term (Ks), show decent agreement with experimental data [4] at the optimized neck length parameter. The neck length parameter increases almost linearly with the surface energy coefficient at the corresponding Ks values taken from ref [3]. For further exploration, we have performed two sets of calculations: one using the average value of K_s within each γ_o, and another using the average value of γ_o within each K_s. The first approach gives a better agreement with experimental data, highlighting the dominant role of the surface energy coefficient (γ_o) in the α-decay process. This work offers an understanding of the sensitivity of α decay observables to the nuclear surface properties. We are in process to extend the analysis to the α-decay chain of 214U including the nearby isotopes (e.g. ,215U,216U and 218U) to investigate the robustness of this behavior across the α decay chain of the residual nucleus and corresponding radioactive isotopes for better understanding of the α-dynamics.

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