

Pre-formation Probability of ${}^5\text{He}$ Cluster in Pre-equilibrium Mechanism

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Abstract: The possibility of ${}^5\text{He}$ cluster emission has been affirmed theoretically. In order to describe the emission probability of ${}^5\text{He}$ cluster, the pre-formation probability of ${}^5\text{He}$ cluster in pre-equilibrium emission process is needed to be established. In terms of Iwamoto-Harada model, the theoretical formula of pre-formation probability of ${}^5\text{He}$ cluster including 1p shell nucleon in pre-equilibrium mechanism has been established and calculated. In the case of low incident energies, the configuration of $[1,m]$ for ${}^5\text{He}$ cluster is the dominant part in the nuclear reaction. The calculated results indicate that pre-formation probability of configuration $[1,m]$ for the unstable ${}^5\text{He}$ cluster is much smaller than those of d, t, ${}^3\text{He}$, and ${}^4\text{He}$, i.e. the light stable composite particles, which are consisted of only 1s shell nucleons. However, it is propitious to the emission of ${}^5\text{He}$ from the point of view on threshold energies, since the binding energies of ${}^5\text{He}$ are generally lower than that of ${}^3\text{He}$ in compound nucleus. The corresponding model formula has been given in this paper for described pre-formation probability of ${}^5\text{He}$ cluster in pre-equilibrium mechanism.

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Key words: composite particle emission, pre-formation probability, nuclear reaction

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