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The synthesis of some Flerovium isotopes Fl, in the island of stability and comparison of their fusion barrier parameters

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Abstract

In the present research, we aim to study the synthesis of some isotopes of Flerovium ${}_{114}^{287}\text{Fl}$, ${}_{114}^{288}\text{Fl}$, ${}_{114}^{289}\text{Fl}$ and ${}_{114}^{290}\text{Fl}$ in the island of stability produced in the nuclear fusion of Ca ions with ${}^{239}\text{Pu}$, ${}^{240}\text{Pu}$, ${}^{241}\text{Pu}$, and ${}^{242}\text{Pu}$ nuclei and to investigate the effect of different directions of target nuclei on the parameters of the fusion barriers. We show that the contact angles of target nuclei influence the parameters of the fusion barriers of ${}^{48}\text{Ca}$ ions with Pu different isotopes; and also we obtain the parameters of the fusion barriers for the synthesis of ${}^{287}\text{Fl}$, ${}^{288}\text{Fl}$, ${}^{289}\text{Fl}$ and ${}^{290}\text{Fl}$ nuclei and compare them with each other. Also, we show that the minimum necessary energies for the synthesis of ${}^{287}\text{Fl}$, ${}^{288}\text{Fl}$, ${}^{289}\text{Fl}$ and ${}^{290}\text{Fl}$ nuclei are 184.16 MeV, 183.95 MeV, 183.75 MeV and 183.56 MeV, respectively. Finally, in the framework of the statistical model, we attempt to estimate the evaporation residue cross section for ${}^{286}\text{Fl}$, ${}^{287}\text{Fl}$ nuclei after the emission of three and four neutrons from ${}^{290}\text{Fl}$ nuclei, showing that in the statistical model framework the results of calculations are in agreement with the experimental data.

Keywords: synthesis of super heavy nuclei, fusion cross section, island of stability

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