APPEARANCE OF THE HINDRANCE TO COMPLETE FUSION IN HEAVY-ION COLLISIONS

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The hindrance to complete fusion is studied as a function of the charge asymmetry of colliding nuclei and orbital angular momentum of the collision. The formation of a dinuclear system (DNS) in the heavy ion collisions is calculated dynamically and its evolution is considered as multinucleon transfer between its fragments. The results prove that a hindrance at formation of a compound nucleus (CN) is related with the quasifission process which is breakup of the DNS into products instead to reach the equilibrated state of the CN. The role of the angular momentum in the charge (mass) distribution evolution for the given mass asymmetry of the colliding nuclei has been demonstrated. The results of this work have been compared with the measured data for the quasifission yields in the ^{12}C+^{204}Pb and ^{48}Ca+^{168}Er reactions to show the dependence of the hindrance on the mass asymmetry of the entrance channel [1]. The new mechanism of the incomplete fusion [2] and the analysis of the mixing of the quasifission yields with the ones of the very asymmetric fusion-fission processes [3] allow us to conclude that complete fusion occurs due to multinucleon transfer through the window (neck) between interacting DNS nuclei. The isotopes ^{272}Ds and ^{280}Ds are formed in the cold ^{64}Ni+^{208}Pb and hot ^{48}Ca+^{232}Th fusion reactions, respectively. In spite of the small fusion probability 10^{-5} in the former reaction, the ER cross section is large $\sigma_{\rm ER}$ = 15 pb due to small excitation energy $E^*_{\rm CN}$=12.7 MeV [4] and large fission barrier of ^{272}Ds. Though the hindrance to complete fusion small for the hot ^{48}Ca+^{232}Th fusion reaction, the maximal value 0.7 pb of the ER cross section was observed for the 4n channel [5] since fission barrier is 3.29 MeV for the CN ^{280}Ds.

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