The effect of two-neutron transfer with positive Q–value on sub–barrier fusion

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It has been proposed for about three decades that the fusion cross section (especially at sub–barrier energy) will be greatly enhanced by the nucleon(s) transfer with positive Q-value due to the additional kinematic energy increase [1,2]. Some experimental results do indeed support this point of view. However, a recent experiment on the fusion of the ^{132}Sn+^{58}Ni system did not show any enhancement caused by the positive Q-values transfer channels comparing to its reference systems [3].

For the sake of simplicity, we focus our attention on two–neutron ($2n$) transfer with positive Q–value. The fusion excitation functions of ^{16}O+^{76}Ge and ^{18}O+^{74}Ge at energies spanning the Coulomb barrier were measured by an electrostatic deflector setup at the HI-13 tandem accelerator of the CIAE. Both systems possess very similar nuclear structures and form the same compound nucleus, but the Q–value of $2n$ stripping channel is $+3.746$ MeV for the latter. Experimental results show that the excitation functions and barrier distributions of these two systems are almost identical, and can be well reproduced by coupled-channels calculations when only the inelastic channels were taken into account. It indicates that no visible effects of positive Q–value $2n$ transfer exist in the ^{18}O+^{74}Ge system.

In order to make clear the effect, a systematic investigation was made on the ^{16,18}O–induced fusions of which the experimental data are available in the literature. However, the situation becomes more complicate, which is beyond the considerations of up–to–date models. The effect of neutron transfer, especially for the case with positive Q–values, on fusion is still an open question.

Details of the experiment, data analysis, systematic investigation, and discussion will be presented in the conference.

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