Sub-barrier Fusion and Neutron Transfer with Positive Q-value

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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 didn't show any enhancement caused by the positive Q-values transfer channels comparing to its reference systems [3].

At first, the effects of multi-neutron transfers with positive Q-value on the sub-barrier fusions for the systems recently measured, such as ^{32,36}S, ^{40,48}Ca projectiles bombarding on ^{90,96}Zr, $^{112-124}$Sn targets, are discussed and summarized briefly. Second, for the sake of simplicity, we focus our attention on two-neutron (2*n*) 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 (cf: Fig.1). Both systems possess very similar nuclear structures and form the same compound nucleus, but the Q-value of 2*n* 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 2*n* 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.

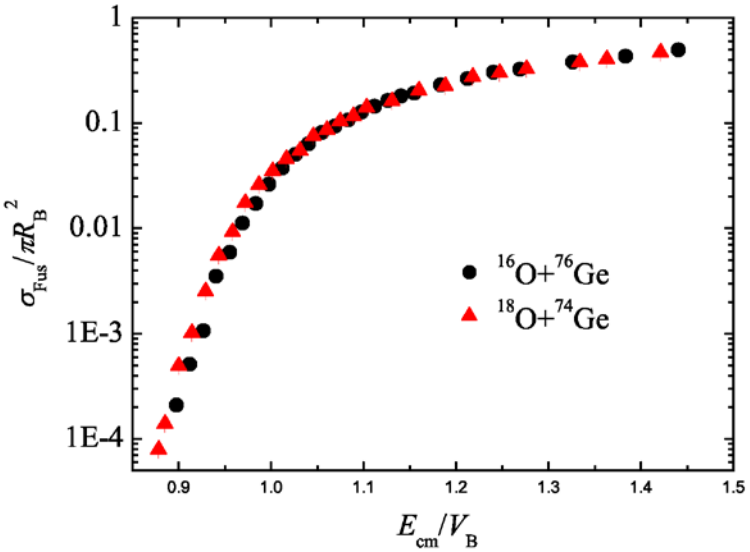

Fig. 1 Fusion excitation functions for the ^{16}O+^{76}Ge and ^{18}O+^{74}Ge systems.

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[2] R. A. Broglia, C. H. Dasso, S. Landowne, and A.Winther, Phys. Rev. C 27, 2433 (1983).
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