Quasi-elastic Barrier Distribution, Elastic and Inelastic Scattering of the $^{18}O+^{64}Zn$ System *

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In this work, we report a complete coupled channel calculation [1], which was compared with experimental data of several nuclear reactions of the $^{18}O+^{64}Zn$ system: quasi-elastic barrier distribution, elastic angular distribution, inelastic angular distribution and inelastic excitation function.

The quasi-elastic barriers distribution [2, 3, 4, 5] is obtained by differentiating the quasi-elastic excitation function respect to the energy. The quasi-elastic barriers distribution and quasi-elastic excitation function were compared with coupled channel calculations (CCC) using the CQUEL code, a modified version of CCFULL [6]. Due to the quantum nature of the coupling channels, the cross sections of the different reaction channels are dependent on each other and therefore the ideal situation is to compare CCC with experimental data for all channels included in the coupling matrix [5]. Because this, we also compared the theoretical calculation with the elastic angular distribution [7] for an energy of E_{LAB}= 49.0 MeV. Moreover, the inelastic excitation function of the excitation states 2_1^+ of the ^{64}Zn and ^{18}O [7], and finally the inelastic angular distributions of the excitation states 2_1^+ of the ^{64}Zn and ^{18}O [7] were also compared.

In the calculations, the real part of the nucleus-nucleus interaction potential was described by the double-folding São Paulo Potential, SPP [8]. As the CQUEL uses potential with the Woods-Saxon geometry, we performed a Woods-Saxon fit to the SPP around the barrier radius (±2 fm), resulting the following parameters for the real nuclear potential: V_0=133.0 MeV, r_0 = 1.06 fm and a_0=0.69 fm. Due to the limited number of excited states accepted by CQUEL (two states of the target and one of the projectile) only the 2_1^+ quadrupole vibration and 3_1^- octupole vibration of the target together with the 2_1^+ quadrupole vibration of the projectile was coupled. Even so, good agreement with the large data set was obtained, which allows us to put in evidence these three channels as the most relevant reaction channels in this system.

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