DISCRIMINATION OF PROCESSES AND REACTION DYNAMICS IN THE ^{17}O+^{58}NI COLLISION AROUND THE COULOMB BARRIER

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Background: The study of reaction dynamics in collisions induced by weakly bound nuclei is often affected by several experimental difficulties. Among these difficulties there are the identification of reaction products which may differ, each others, by few mass units and the discrimination of the different reaction channels which contribute to the overall reactivity of the collision participants.
Purpose: The main goal of this work is to contribute to the study of reaction dynamics in collisions induced by weakly bound nuclei introducing new results and new data analysis methods to overcame the typical encountered problems.
Method: The collision ^{17}O+^{58}Ni was studied by means of a detailed analysis of the experimental spectra based on Monte Carlo simulations. The elastic scattering angular distributions at five near-barrier energies were measured in order to compare the reactivity of ^{17}O (Sn=4.143 MeV) with its mirror nucleus ^{17}F (Sp = 0.600 MeV) and the tightly bound ^{16}O projectile. Data were analyzed employing Monte Carlo simulations in order to discriminate the contributing reaction channels and were investigated within the framework of the Optical Model using Woods-Saxon and double-folding potentials.
Results: The resulting fit parameters are compatible with those available in literature for the collision of ^{17}O nuclei with different light, medium and heavy targets. The used models employed a ^{17}O nucleus description as a ^{16}O core and a valence neutron in a $d^{5/2}$ shell. The reduced total reaction cross sections shows that, with respect to the ^{16}O+^{58}Ni system, the ^{17}O reactivity is compatible with the commonly observed behavior of weakly bound nuclei. Furthermore a strong contribution from the 1n-stripping channel was observed.
Conclusions: The experimental difficulties in the study of reaction dynamics in collisions induced by weakly bound nuclei were hence faced with the help of Monte Carlo simulations which allowed the extraction of the total reaction cross section and the 1n-stripping angular distributions.