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Reaction mechanism studies of multi-nucleon transfer reactions in 206Pb(18O, X) at above the Coulomb barrier energy

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The single- and multi-nucleon transfer reactions, namely, 206Pb(18O, x); x= 19O, 17O, 20O, 16O, 18N, 17N, 16N, 15N, 14N, 16C, 15C, 14C, 13C, 12C, 12B, 11B, 10B, 10Be and 9Be have been studied at an incident 18O energy of 139 MeV. Reaction channels involving transfer of up to nine nucleons have been detected. Total kinetic energy loss spectrum and angular distribution of cross sections have been measured. The Q-value and angle integrated cross sections are deduced. Elastic scattering angular distributions have also been measured and are analyzed by optical model program SFRESCO. Fully microscopic Time Dependent Hartree-Fock (TDHF) model calculations, based on independent single nucleon transfer mode, have been carried out and are compared with the experimental data of multi-nucleon transfer reactions. The TDHF calculations give a reasonably good agreement with the measurement for few nucleon transfer process, however, the theory becomes less accurate as the number of nucleons transferred increases. An attempt has been made to include effects due to particle evaporation in the production cross section by employing a statistical model calculation. Inclusion of evaporation effects gives some improvements towards the measurement, however, the calculations still under predict the measured cross section by a significant amount especially for the cases where a large number of nucleons transferred are involved. Possible origin of these discrepancies and importance of multi-particle correlations / pairing effects are discussed.

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