Elastic scattering angular distributions and fusion cross sections for weakly bound nuclei ^{7}Be, ^{7}Li on ^{9}Be

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The effect of breakup of weakly bound projectiles has been investigated for a range of systems over different energy spans both experimentally and theoretically [1]. The recent availability of radioactive ion beams has further triggered a good number of studies to investigate reactions involving unstable nuclei. The present study has been carried out in order to further investigate the interaction of radioactive nucleus ^{7}Be with another loosely bound nucleus ^{9}Be. However, due to experimental difficulties and low intensity of RIBs, such studies are limited. In view of the similarities of weakly bound stable systems with their associate radioactive ones, the comprehension of the reaction mechanism induced by intense beams like ^{6,7}Li should be important for the study of reactions induced by low intensity RIBs. ^{7}Be is the mirror nucleus of ^{7}Li with a $(1/2)^{-}$ state at 0.43 MeV, similar to that of ^{7}Li at 0.478 MeV. Therefore, in order to do a comparative study we have carried elastic scattering and fusion measurements for ^{7}Li + ^{9}Be system, similar to the approach followed for ^{7}Be,^{7}Li + ^{27}Al [2].

We have measured the elastic scattering angular distributions for ^{7}Be + ^{9}Be system at E_{lab}=17, 19 and 21 MeV and one proton stripping reaction cross sections at E_{lab}= 19 and 21 MeV, in the angular range $\theta_{c.m.}$ = 26^{o} - 58^{o} [3], using ^{7}Be HIRA-RIB facility [4] at Inter University Accelerator Centre, India. In order to obtain total energy and position of the scattered particles, we have employed a ΔE-E telescope which consisted of a gas detector and a combination of two large area position sensitive Si detectors (50mm x 50mm), placed adjacent to each other. The elastic scattering angular distributions were subjected to optical model (OM) analysis in order to obtain optical potential parameters which can be used to analyse transfer data and to extract reaction cross sections. Fusion cross sections were estimated by subtracting integrated transfer reaction cross sections form the reaction cross sections obtained form optical model calculations.

Elastic scattering and fusion cross sections were measured for the ^{7}Li + ^{9}Be system at E_{lab} = 15.75, 24 and 30 MeV in the angular range $\theta_{c.m.}$ = 7^{o} - 70^{o}. For fusion the α-evaporation spectra were measured at two of the backward angles at each energy. The elastic scattering angular distributions were subjected to OM analysis. The α evaporation spectra were reproduced with the statistical model calculations, and the fusion cross sections were extracted therefrom. The extracted fusion cross sections were compared with the CCDEF calculations for both the systems.

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