Importance of n-Stripping process in the ^{6}Li+^{159}Tb reaction at near barrier energies

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Our recent works on the systematic measurements of complete fusion (CF) and incomplete fusion (ICF) excitation functions for the reactions ^{6,7}Li+^{159}Tb and ^{10,11}B+^{159}Tb [1, 2] have shown that the CF cross sections at above–barrier energies are suppressed for reactions with weakly bound projectiles and the extent of the suppression is correlated with the α–breakup threshold of the projectile. The measurement also showed that the α–emitting channel is the favoured ICF process. In the context of these observations, inclusive measurement of outgoing α–particles was carried out for the ^{6}Li+^{159}Tb reaction. The total (angle-integrated) cross sections of the inclusive α–particles have been measured at five bombarding energies of 23, 25, 27, 30 and 35 MeV (VB $\sim$27 MeV). Since this is an inclusive measurement, several processes may contribute to the inclusive α–particle yield. As we have not done any exclusive measurement, the α-particle cross sections corresponding to the non-capture breakup (NCBU) process (^{6}Li +^{159}Tb $\rightarrow \alpha$ + d + ^{159}Tb) have been calculated in the continuum discretised coupled channels (CDCC) formalism using the code FRESCO [3]. The CDCC calculated NCBU cross sections are found to be much less than the measured inclusive α-particle cross sections. Therefore, α-particles produced in other processes must be contributing to the inclusive α-particle yield. From the γ–ray spectra of fusion excitation function measurement for the ^{6}Li+^{159}Tb reaction cite2, we have extracted the cross sections of the α–emitting channels corresponding to the *d*-capture ICF process and also the cross sections of the ^{160}Tb nuclei corresponding to the single-neutron stripping process. In the *n*–stripping process, the α–unstable ^{5}Li nucleus is produced that instantaneously decays into α and *p*. The *n*–stripping cross sections have been calculated in the distorted wave Born approximation (DWBA) formalism using the code FRESCO [3]. We have found that the sum of the cross sections corresponding to the *d*–capture ICF process and the single–neutron stripping process is very close to the measured inclusive $alpha$–particle cross sections in the present energy region of investigation. So the *d*–capture ICF process and the single–neutron stripping process are the dominant contributors to the total α–particle yield in the ^{6}Li+^{159}Tb reaction at energies around the Coulomb barrier.

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