Fission fragment mass and angular distribution in ^{6,7}Li+^{235,238}U reactions

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The fission fragment (FF) mass and angular distributions provide a lot of information about the structure and reaction mechanism involving two interacting nuclei. The breakup of weakly bound projectiles like ^{6,7}Li is expected to play an important role in modifying the energy dependent behavior of different observables like FF angular anisotropy and FF mass distribution [1,2]. To investigate these effects we carried out FF angular distribution measurements for ^{6,7}Li+^{235,238}U and mass distribution for ^{6,7}Li+^{238}U reactions. In addition to the projectile breakup effect, the effect of target spin was also investigated while comparing the FF angular anisotropies for ^{6,7}Li+^{235}U reactions with those for ^{6,7}Li+^{238}U reactions.

FF angular anisotropies (W(180)/W(90)) for ^{6,7}Li involving ^{235}U target (with s=7/2) at sub- and near-barrier energies were found to be much smaller compared to the ones involving ^{238}U target (with s=0) indicating that the larger target spin has reduced the FF anisotropy, as expected. Secondly, the FF anisotropies calculated by saddle point statistical model (SSPM) were found to be closer to the measured anisotropies for the reactions involving ^{235}U.

The FF mass distributions were measured by time of flight method. The ratio of peak to valley (P/V) of the mass distributions, that gives the information about the nuclear heating, was derived as a function of excitation energy. It showed distinct behavior compared to the ones involving p or n induced fission reactions. The ratio was found to increase more rapidly with the decrease of excitation energy. This indicates that the compound nuclei are populated with lower excitation energy than expected from a complete fusion, which is possible when a fraction of compound nucleus formation is populated by breakup fragments (i.e. incomplete fusion). This observation was supported by comparing the angle integrated fission cross sections, where it was found that the fission cross sections at sub–barrier energies for ^{6}Li induced reactions are much larger than the ones for ^{7}Li induced reactions implying larger contribution of breakup induced fission in case of the former due to lower breakup threshold.

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