Variation of intermediate mass fragments with the mass of the fragmenting system

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Introduction

It is now almost an established fact that a projectile spectator, when excited up to its binding energy or beyond, often breaks up into several parts of intermediate mass fragments (IMF) with their masses lying between alpha particles and fission fragments. The phenomenon is known as multifragmentation. Correlation between mean multiplicity of IMF $<N_{IMF}>$ and the mass of the fragmenting system, whose measure is so called bound charge Z_b where $Z_b = \sum_i Z_{PF_i}$ with $Z_{PF_i} \geq 2$, is an aspect of projectile multifragmentation that has been studied thoroughly by a number of groups[1-5]

For a given collision system, the magnitude of Z_b is independent of the beam energy giving the idea of the energy transferred to the excited spectator system and is also taken as a measure of the degree of centrality of the collision. On the other hand, when the variation of $<N_{IMF}>$ is studied with Z_b for a given projectile, in reactions with the lighter targets, the maximum value of the mean multiplicities of IMFs depend on the bombarding energy if the later is less than a specific minimum value. As reported by ALADIN group [1-5], specific minimum bombarding energies are about 400, 800 and 1000 MeV per nucleon for collisions of gold projectiles with aluminium, carbon and beryllium targets respectively. From their report it is therefore readily evident that for the same projectile, as the target mass increases, the specific minimum value of the beam energy for attaining the maximum mean multiplicity of IMFs, when plotted against Z_b, decreases. as heavy as the disintegrating projectile. This broad mass range is correlated with the large range of fragments multiplicities.

In this paper an attempt has been made to study the correlation between $<N_{IMF}>$ and Z_b for projectile fragmentation data obtained from NIKFI-BR2 (JINR) emulsion stacks exposed to 4.5 AGeV ^{24}Mg beam.

Results and discussion

Frequency distribution of various charged projectile fragments with $Z_{pf} \geq 1$ emitted from Mg-Em interactions is plotted in Fig. 1.

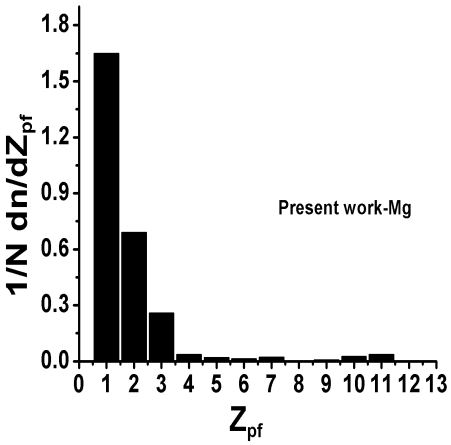

Fig. 1 Frequency distribution of all the projectile fragments.

From this figure it can be readily seen that, irrespective of target mass, the emission of light projectile fragments are most abundant [6].

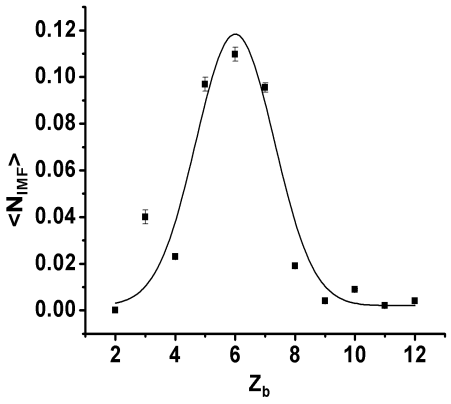

Fig. 2 Variation of $<N_{IMF}>$ with Z_b for Mg-Em interactions

The variation of $<N_{IMF}>$ on the mass of the fragmenting system is shown in Fig. 2 for Mg-Em interactions. In Fig. 3 the variation of $<N_{IMF}>$ with Z_b for our result and that of the results obtained by other workers is shown. It is clear from the figure that our results agree well with the ALADIN results. When the results of ALADIN and KLMM were compared for the same projectile, but with different E/A, KLMM group observed that their results agreed well with ALADIN results only for high Z_b. At low Z_b, the difference is significant.

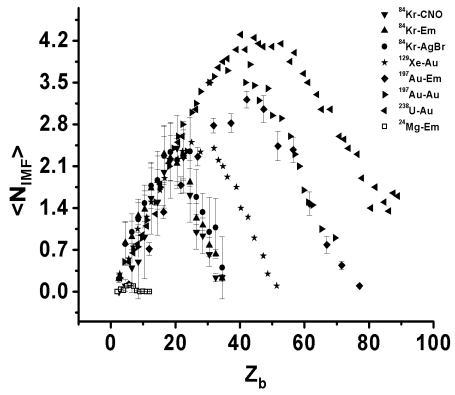

Fig. 3 Variation of $<N_{IMF}>$ with Z_b for the works of different groups.

It is also intersting to see from Fig. 3 that, the emission of intermediate mass framents decreases with decreasing system size.

Acknowledgement

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