Fission mass width systematics in A ∼ 200 region.

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Studies of fusion-fission (FF) reactions involving heavy ion projectiles and heavy targets provides a lot of information on the fission reaction mechanism and has been a topic of great interest in recent years. Synthesis of super heavy elements (SHEs) is extremely challenging because the formation of SHEs is strongly hindered by non-equilibrium processes such as fast-fission, quasifission (QF), and pre-equilibrium fission etc [1]. The competition between QF and compound nucleus (CN) formation determines the probability of evaporation residue survival, which is crucial in understanding the dynamics of FF for heavy and SHEs production. Variation of the width of the fragment mass distribution with excitation energies is considered to be a valuable probe for studying QF [2, 3]. In this work, our aim is to explore the nature of non compound processes by comparing our recent results of the systematic study of variation of fragment mass width with existing data in literature, in mass ∼ 200 region.

Recently, we have measured the mass distributions of isotopes of Pt (^{188,190}Pt), populated through the fusion reactions ^{28}Si + ^{160}Gd and ^{12}C + ^{178}Hf, respectively, at energies around and above the Coulomb barrier [4]. The fragment mass distributions for both the Pt isotopes were found to be single peaked and no appreciable change in the mass symmetry was observed throughout the measured excitation energy range, for both the reactions. However, relatively broader mass distributions observed in the fission of ^{188}Pt in the studied energy domain indicates the presence of fission events originating from a non-equilibrated source as well. This signifies that the mass equilibrium has not been

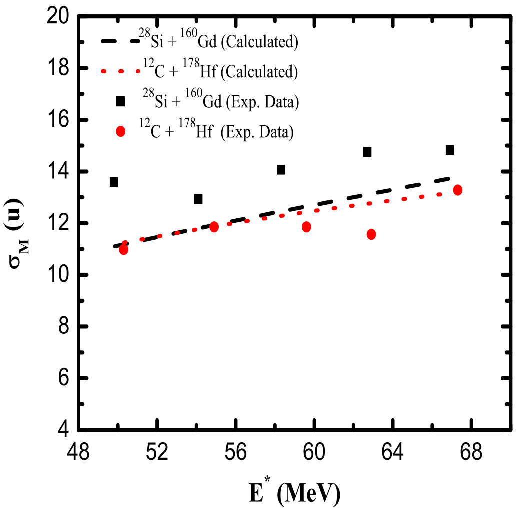

FIG. 1: Variation of the experimental fragment mass width (σ_m) values for the two reactions with excitation energy. The calculated values are shown by the dotted and dashed lines.

fully achieved in the ^{28}Si + ^{160}Gd system as compared to the ^{12}C + ^{178}Hf system. Fig. 1 shows the experimental and calculated σ_m as a function of CN excitation energy for the two systems. Similar type of study by Chaudhuri et al. [6], claimed that the width of mass ratio distributions increases monotonically with excitation energy and there was absence of any deviation from the statistical model predicted width [8] of the mass distribution at all energies for the reactions ^{16}F + ^{181}Ta and ^{16}O + ^{184}W. Hence, their findings claims that QF is not significantly present in either of the two reactions. Moreover, Ramachandran et al. [5], investigated the role of shell effects in this mass region, through the fission fragment mass distribution measurements for the

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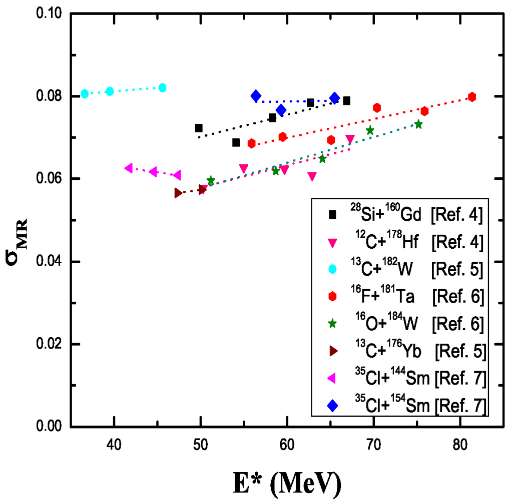

FIG. 2: Variation of the experimental fragment mass ratio width (σ_{MR}) values with excitation energy for reactions studied in this work. Dotted line represent the linear fit of the experimental data.

^{13}C + ^{182}W, ^{176}Yb reactions and observed an asymmetric mass split for ^{195}Hg, whereas for ^{189}Os, the mass distribution is well fitted with a single Gaussian distribution. The measurement of mass distributions in ^{35}Cl + ^{144,154}Sm at near-barrier energies by Tripathi et al. [7], shows that the behaviour of mass distributions deviates from the one expected on the basis of a pure liquid drop model, indicating a contribution from asymmetric fission. The variation of width of mass ratio (σ_{MR}) with excitation energy from our study [4] along with some of other existing measurements [5–7] in 200 mass region is shown in Fig. 2. The dotted lines represents the linear fit to the experimental data. The general trend of linear fit to the data shows that the variance follow a consistent trend of slow increase with the excitation energy for relatively lighter projectiles (C, O, F etc.) with the strong exception of ^{13}C + ^{182}W reaction [5], where, variance is relatively high when compared to other similar reactions. This discrepancy should further be explored populating ^{195}Hg and nearby compound systems using other reaction channels covering wider range of excitation energy. In summary, for better understanding of complex fission dynamics, more experimental data are required from the fission of relatively neutron deficient nuclei in A $\sim$ 200 mass region.

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