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New information on survival probabilities in hot fusion reactions[1]

WALTER LOVELAND, Oregon State University — Recently we studied the fission-neutron emission competition in highly excited ($E^* = 63$ MeV) ^{274}Hs (Z=108) (where the fission barrier is due to shell effects) formed by a hot fusion reaction. At this excitation energy, these shell effects are expected to be "washed out" leaving a barrier height of ≤ 1 MeV. Matching cross bombardments (^{26}Mg + ^{248}Cm and ^{25}Mg + ^{248}Cm) were used to identify the properties of first chance fission of ^{274}Hs. A Harding-Farley analysis of the fission neutrons emitted in the ^{25,26}Mg + ^{248}Cm reaction was performed to identify the pre- and post-scission components of the neutron multiplicities in each system. (Γ_n/Γ_t) for the first chance fission of ^{274}Hs is 0.89 ± 0.13, i.e., $\sim 90\%$ of the highly excited nuclei survive. The high value of that survival probability is due to dissipative effects (Kramers) during de-excitation. A proper description of the survival probabilities of excited superheavy nuclei formed in hot fusion reactions requires consideration of both dynamic and static (shell-related) effects. A re-analysis of several hot fusion survival probabilities under these constraints is presented.

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