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The synthesis of heavy and superheavy nuclei from the Z = 100 - 106 region in the pxn and axn channels

The fusion probability for the production of superheavy nuclei (SHN) in cold fusion reactions (1n channel) on ^{208}Pb and ^{209}Bi targets drops by approximately five orders of magnitude, from 10^{-1} to 10^{-6}, with the change of projectile atomic number from 20 (Ca) to 30 (Zn). Recent experimental results for reactions induced on ^{208}Pb target by ^{48}Ca, ^{50}Ti, and ^{54}Cr projectiles show that the probability of compound nucleus formation at energies above the interaction barrier (B_0) can be significantly higher, up to two orders of magnitude, than its value at the peak of the 1n channel and weakly depends on the bombarding energy. As a result, the fusion cross section saturates at higher excitation energies, opening the pathway not only to xn channels but also channels with the emission of charged particles. The channels involving the emission of protons or alpha particles have typically been disregarded in calculations. However, recently revised experimental data indicates that the proton channel could be populated in the ^{50}Ti + ^{209}Bi reaction.

In this talk, we will explore the potential of utilizing the pxn and axn channels for the successful synthesis of heavy and superheavy nuclei in the Z = 100 - 106 region. We will focus on identifying the reactions that might receive increased attention in the future with the availability of more intense beam currents.

The culations were performed with the latest version of the Fusion-by-Diffusion model [1] assuming that the evaporation residue cross section can be described as a product of three factors: the capture cross section, the fusion probability, and the survival probability. The merging of the colliding projectile and target nuclei was described as a diffusion process. The survival probabilities were obtained using new nuclear data tables for SHN [2], providing a consistent set of masses, deformations, fission barriers, and shell corrections.

REFERENCES

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