Study of fusion reactions forming the Cf nuclei

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From the observation of the decay of the heaviest nuclei, basic data for understanding the formation processes and properties of nuclei at the limits of stability as determined by the interplay of the nuclear and Coulomb forces can be obtained.

The most successful reaction type for the production of heavy nuclei is fusion of two colliding nuclei to form an excited compound nucleus, which subsequently deexcites by evaporation of few neutrons [1]. However, this so called fusion-evaporation reaction is strongly dominated by the fusion–fission reaction which is the main deexcitation channel of the excited compound nuclei [2]. Thus, the investigation of the physical and chemical properties of heavy and superheavy nuclei is limited by their production rates.

We have performed several complementary experiments to enhance our understanding of fusion processes in a region of the chart of nuclei directly relevant for superheavy element studies. The influence of the neutron numbers of the projectile and target nuclei was investigated in ^{34,36}S+$^{204,206-208}$Pb fusion reactions by measuring the evaporation residues and fission fragments at the velocity filter SHIP of GSI Darmstadt, Germany and at the Tandem accelerator of JAEA Tokai, Japan [3, 4], respectively.

In a different set of experiments, mass angular correlations of the fission fragments from the above mentioned reactions were investigated at the 14UD Pelletron electrostatic accelerator of Australian National University in Canberra, along with other colliding systems like ^{12}C+^{235}U, ^{37}Cl+^{205}Tl and ^{44}Ca+^{198}Pt, which all lead to Cf compound nuclei.

Results from the above mentioned experiments will be presented.

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