APPEARANCE OF NUCLEAR SHELL EFFECTS AND INITIAL CHARGE (MASS) ASYMMETRY IN FORMATION OF PRODUCTS IN HEAVY ION COLLISIONS

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The initial mass (charge) asymmetry and nuclear shell structure of colliding nuclei play decisive role in the dynamics of heavy ion collision and formation of reaction products at near Coulomb barrier energies. The shell structure of the being formed fragment determines the probability of its yield in the experiment. These peculiarities are important at theoretical calculations devoted to analyze and predict the favorable conditions to synthesis of new superheavy elements or nuclei far from the valley of beta-stability. The results of the analysis searching a favorable reaction to synthesize the new superheavy element $Z = 120$ are discussed. The effect of increasing of the fission barrier for isotopes of $Z = 120$ by the decrease of their mass number, as predicted by Sobiczewski and his colleagues [1], is studied. The cross sections of complete fusion and formation of the evaporation residues in the ^{50}Ti+^{249}Cf and ^{54}Cr+^{248}Cm reactions leading to the compound nuclei ^{299}120 and ^{302}120, respectively, are compared. The fusion cross section of the former reaction should be larger due to large mass and charge asymmetry in comparison with the one for the latter reaction. But the neutron number of compound nucleus formed in the reaction with ^{54}Cr is larger than that in the reaction with ^{50}Ti and its survival probability seems to be larger than the one of the compound nucleus formed in the ^{50}Ti+^{249}Cf reaction. The behavour of the fission barrier of nuclei with $Z = 120$ as a function of the neutron number indicates a larger survival probability in the ^{50}Ti+^{249}Cf reaction. These intriguing primary results will be presented and discussed. The partial fusion cross sections are calculated in the model based on the dinuclear system concept [2-3] and the survival probability of the heated and rotating compound nucleus is estimated by the advanced statistical model [4].

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