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Temperatures of entrance window and target operating at high intensive heavy ion beams in the future experiments on synthesis of superheavy nuclei

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The detailed study of properties of superheavy nuclei (SHN) in the experiments with the complete fusion reactions induced by the 48Ca projectile on actinide target nuclei, which lead to 112≤Z≤118 nuclei, implies the use of heavy ion (HI) beams with the intensity significantly higher than the one used earlier in the discovery experiments with the 48Ca beam. Synthesis of SHN with Z>118 implies the use of the heavier than 48Ca beam particles (50Ti, 54Cr etc.). And also to improve the efficiency of SHN yield, it is necessary to increase the thickness of the actinide oxide deposited onto the target backing.
In this report, the durability of the entrance window and target working at high intensive heavy ion beams is considered. The durability of the entrance window and target is estimated as the result of the action of an intense heavy ion beam. The assessments of these actions that determine the durability of the entrance window and target are discussed. The temperature of the entrance window is calculated as a function of time in the conditions of its pulsed heating by means of a heavy ion beam, followed by radiative cooling with radiation emitted from its surface. The entrance window temperatures are calculated for heavy ion beams, such as 48Ca, 50Ti, 54Cr and 58Fe, with their intensities expected for the DC-280 accelerator. With these calculations of the temperature dependences against the time of the beam action the optimal parameters of the entrance window operation are chosen.
The optimal rotational speed of the target is determined by varying the thickness of the actinide oxide and radius of the target.

Summary

As a result of this work, the optimal parameters of the entrance window and the target of a gas-filled separator were chosen. Also, temperature dependences were calculated with increasing thickness of actinide oxide, in order to increase the efficiency of superheavy element yield.

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