THE CONCEPT OF A SYSTEM OF MULTILEVEL PROTECTION OF THE FUEL LAYER DURING CRYOGENIC TARGET DELIVERY AT THE FOCUS OF A POWERFUL LASER FACILITY OR ICF REACTOR

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The problem of use of the cryogenic fuel targets (CFT) in the experiments of inertial confinement fusion (ICF) and, especially, in a future reactor, includes not only a problem of fabricating a qualitative cryogenic fuel layer (nonuniformity < 1%, roughness < 1 micron), but also a problem of CFT delivery in the laser radiation area under conditions of survival of the fuel layer parameters.

The conducted researches have shown that the CFT formation and delivery necessarily includes the system of multilevel protection of a fuel layer which is based on the following principles:

1. Application of a fuel layer with an isotropic ultra-fine structure for decrease in layer sensitivity to external thermal and mechanical overloads.
2. Application of a contactless delivery of the ensemble «CFT + HTSC Sabot» for decrease in the thermal flux on a CFT arising due to friction of the sabot about the walls of the injector guide tube (sabot is a CFT carrier, HTSC is an abbreviation from a high-temperature superconductor).
3. Application of a conic support of a target nest in the sabot for decrease in the mechanical overloads arising during acceleration of the ensemble «CFT + HTSC Sabot».
4. Application of external coating on CFT for lowering the risks of fuel layer damage under exposure the radiation of hot walls of the ICF reactor chamber, including: external protective cryogenic layers (from the solid D2, H2, or Xe), external protecting metal layers as a covering from Pt, Pd and their alloys, application of a double protecting layer «Metal layer + Cryogenic layer».
5. Co-injection of CFT and protective cover made from the solid gases which forms a wake area in the fill gas to avoid convective heating in the ICF reactor chamber.

In this report, the results of experimental and theoretical studies are presented, which have allowed formulating the concept stated above.

This work was supported by the Russian Foundation for Basic Research under Project No. 15-02-02497 and № 06-08-01575-а, by the International Atomic Energy Agency under Research Contract No. №20344, and by the Russian Academy of Sciences Program of Basic Researches and by the Russian Government (in the frame of the State Task Program).