FORMATION OF A CRYOGENIC FUEL LAYER IN MOVING SHOCK IGNITION ICF TARGETS [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2023.50.2023.1.1.098

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The objective of this work is to discuss the prospects of the formation of cryogenic shock ignition targets based on the FST-layering method proposed and developed at the Lebedev Physical Institute are discussed (LPI) [1]. The targets are designed to study alternative fuel ignition schemes at intermediate and megajoule-scale ICF laser facilities. These targets have a low initial aspect ratio because they are expected to be more hydrodynamically stable during implosion [2].

The results of modeling the main stages of the implementation of the FST method (**f**ree-**s**tanding **t**arget ‒ work with unmounted SI-targets) are discussed: 1) depressurization of the shell container (SC), 2) formation of a solid fuel layer inside unmounted shells freely moving in a spiral layering channel (LC). The following results are obtained:

− The temperature Tdiff was determined, below which the back gas diffusion from the shells is negligible for the polymers under study, including: for polystyrene − Tdiff < 100 K, for polyimide and GDP-polymer − Tdiff ~ Tcp, where Тcp is the critical temperature of the fuel substance.

− Depressurization temperature Td was determined, at which it is possible to remove the fuel from the SC without the shells damage by internal pressure: (a) at Td = 45 K and the tensile strength of the shell material σ = 110 MPa, the fuel gas outside the shells can be removed; (b) for low-strength shells (σ < 50 MPa), the SC depressurization can only be carried out at a temperature Td < Tcp for both types of fuel (D2 and D-T mixture).

− After the SC depressurization and temperature decrease to Tin ≤ Td, the shells with fuel are injected under the gravity into the LC to form a solid cryogenic layer according to the FST layering method. Calculations showed that the layering time does not exceed 30 s for the initial temperature Tin = 30 K, and 22 s for Tin = 26 K for both fuel types (D2 and D-T mixture).

− The optimal LC parameters were determined for the case of SI-targets to realize their in-line motion inside the spiral LC: (a) LC in the form of a double spiral (initiation angle α = 11.50, radius and height of the spiral R = 21 mm and H = 450 mm, correspondingly), or (b) triple spiral (α = 16.70, R = 21 mm and H = 880 mm). A set of the control experiments was carried out, which confirmed the calculations: the rolling times were τrol = 23.5 s (double spiral) and τrol ~ 35 s (triple spiral).

References

1. [Aleksandrova I.V. et al. Nuclear Fusion, 2021, **61**, 126009
2. Brandon V. et al. Nuclear Fusion, 2014, **54** (8), 083016
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/It/ru/DO-Alexandrova.docx) [↑](#footnote-ref-1)