1D simulation of compression of indirectly irradiated targets with different ablators under conditions of the NIF installation [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2020.47.1.083

Rozanov V.B., Vergunova G.A.

Lebedev Physics Institute of the Russian Academy of Sciences, Moscow, Russia, vergunovaga@lebedev.ru

Using a favorable one-dimensional model [1] based on the 1D RADIAN code, we have simulated the dynamics of compression of indirectly irradiated targets containing capsules with plastic and high-density carbon and beryllium ablators. The experiments with such targets were made and are planned to be made on the NIF installation of the Livermore laboratory, USA.

The simulation has been performed with the help of the RADIAN code in one-dimensional geometry. The two-temperature equations of hydrodynamics (the equations for motion, continuity, change of energy for the electronic and ionic components, equations-of-state for ions and electrons) together with the multi-group spectral radiation transfer equations were solved. The radiation spectral absorption coefficients were calculated using the THERMOS code [2] (Inst. Appl. Math.). Electron-ion exchange and classical or reduced Spitzer heat conductivity were taken into account. The laser radiation energy is absorbed by the Bremsstrahlung procedure. Laser radiation that reaches a point of critical density is completely absorbed at this point. The contribution of
α particles to the energy equation is taken into account.

A numerical simulation for the compression was carried out for five targets, the experiments with which were performed on the NIF installation in 2014–2018, as well as for targets for the total energy of 1.8 MJ of the NIF laser [3]. The calculation results using the 1D RADIAN code are within the range of experimental and calculation results of the LLNL. The one-dimensional model describes adequately the process of compression of a target capsule and shows a tendency to variation at changing of target and laser pulse parameters. Existing uncertainties in the properties of ablator materials and DT fuel affect the used equations of state and optical constants. Ultimately, uncertainties in the properties of these materials affect the results of numerical simulation.

The 1D model confirms the influence of the hard part of the hohlraum X-ray spectral radiation on an increase in the adiabatic index of the capsule compression process. A change in the properties of the ablator leads to a change in the spectrum that heats up the DT fuel. Earlier, it was shown
in [4] that layers of heavy elements (Cu) can be used in the capsule in order to absorb the hohlraum hard x-ray radiation and to achieve ignition.

This work was supported by the Russian Foundation for Basic Research, project 19-02-00299.

References

1. Rozanov V. B., Vergunova G. A., JETP 148, 857 (2015).
2. Nikiforov A.F. Novikov V.G., Uvarov V.B., Quantum-statistical models for high- temperature plasma, (Moscow: Fizmatlit, 2000).
3. Clark D.S., Kritcher A.L., Yi S.A., Zylstra A.B., Haan S.W., and Weber C.R.,
4. Phys. Plasmas **25**, 032703 (2018).
5. Rozanov V.B., Vergunova G.A., JETP 154, 919 (2018).
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/It/ru/CP-Rozanov.docx) [↑](#footnote-ref-1)