Direct drive fusion targets under laser pulse of a megajoule Level

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The talk presents the results of numerical and theoretical investigations of a possibility of a spherical direct drive target spark ignition. Traditionally the target consist of two-layer thin shell, activated by a temporary shaped pulse of 2ω0 Nd-laser radiation, which has energy about 2 MJ. In result the sufficiently stable targets were proposed. So, the aspect ratio is from the range of 6-10. The dynamics characteristics of a compression such the targets provide an evaporation of a significant part of an ablator’s substance during an implosion process. It means, that an effective ablation stabilization of a hydrodynamics instabilities development at an acceleration stage as well as a decrease of a mixing level between DT-fuel and ablator’s substance can be provided. The shaped laser pulse to coordinate with such the targets has the duration about 10-11 ns. The power contrast of the temporary laser form is forty (maximal value is 400 TW).

Two groups of the simulations are used for an analysis of the efficiency of targets and for their optimization. One of them provides the calculations of an interaction the shaped pulse laser radiation with a target, including a definition of total laser energy, which was absorbed, i.e. the total absorption coefficient due to a bremsstrahlung as well as to a resonance mechanism. The calculations of a space distribution of such heating of an ablator were fulfilled also for the real irradiation geometry by 192 laser beams within a scheme of Russian Mega joule Project. The second group of simulations was devoted to numerical studies of a total target evolution cycle under the action of the absorbed laser radiation to find the fusion gain.

The simulations have demonstrated a possibility to reach the gain about 40 as well as the compression up to areal density value of 1.5 g/cm2 . The target can provide the ignition even at two times decreasing of the areal density (for example, due to DT-ablator mixing). Moreover, the compression characteristics and the fuel burning have a sufficiently week sensitivity upon target data mismatch as well as a laser pulse ones. It concerns the equations of state and transport properties also.