Atomic-Mix Effect on the Performance of Indirect-Drive Deuterium-Deuterium Implosions

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Implosion mix is a critical issue for achieving ignition in inertial confinement fusion. In the indirect-drive scheme, the higher Z ablator materials could penetrate into the fusion fuel because of the hydrodynamic instability growth of the interface between the ablator and fusion fuel. In the ignition target, most of the higher-Z material mix with the iced Deuterium-Tritium (DT) layer, however, it is also possible for the higher-Z ablator to be mixed into the hot-spot via the defects-induced jets.

In this talk, we present the performance of argon-doped implosion experiments, in which Deuterium-Deuterium reaction was used for the substitute of the DT fuel. The experiments were conducted at the Shengguang-II laser facility. The doping-faction of argon was chosen as 1%, 2% and 10% (atomic fraction). The temperature and density of electrons are determined by the K-shell emission spectra of the highly-ionized argon. The size of hot spot was recorded by the time-resolved pin-hole-array x-ray imaging. The neutron yields were detected by both BF_3 and scintillator detectors. A strong correlation between argon x-ray line intensity and neutron yields have been found in the experiments, and the convengence ratios deduced from the hot-spot imaging agree well with the numerical simulation for the different doping fraction which brings about the change of the equation of states and radiative opacity.

References

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