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Effect of High-Z Doping on ICF TN Performance and Ignition[1]

YI-MING WANG, Los Alamos National Laboratory — One of the challenges of ICF ignition is to achieve desired areal density ρR of the hot-spot region so that a self-sustained TN burn could be initiated and maintained. The recent study of the NIC data indicated that the areal density ρR of the hot-spot inferred by the DSR was lower than the ignition requirement set by ITF. In this work, we will study the effect of Hi-Z doping in the DT gas on the ICF TN performance. The mechanism of the high-Z doping is to utilize additional radiative cooling of high-Z doping during the implosion phase of the evolution so that the gas cavity will follow a lower adiabatic path. This allows a more isothermal compression of the gas to a high density and ρR at the center of the target. The radiative cooling caused by mixing of high Z material into the gas region was considered to degrade to the performance of ICF capsule. However, a trace of high-Z doping enhances both the TN performance as well as the hot-spot ρR. Overall, for a transparent pusher design, over 38% of improvement of gas (hot-spot) ρR and over 200% increase of the yield rate compared to the baseline design have been achieved using this. For an opaque pusher design, no TN performance improvement had been observed in calculation.

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