Ionic Species Separation In The Hot Spot Of Marginally Igniting Targets

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In inertial confinement fusion (ICF), a capsule of deuterium (D) and tritium (T) fuel is compressed by lasers to obtain hydrodynamics conditions required for thermonuclear fusion. In direct drive and in indirect drive, the implosion of a target in ICF is decomposed in acceleration, deceleration and stagnation. During the deceleration, shock waves propagate through the hot spot and the compressed shell, and bounce at the target center. In this work, we address the whole deceleration phase towards stagnation by the use of spherical multi ionic Fokker-Planck code *FPion* 1D/2V (one spatial dimension, two velocity dimensions). Electrons are considered as a background neutralizing fluid. Thermonuclear reactions and radiative losses are not taken into account. We show a deuterium and tritium separation during the deceleration phase in the hot spot of marginally igniting DT cryogenic targets. A huge variety of target designs is analyzed with variation of implosion velocity between 260-320 km/s, for different initial aspect ratios and in-flight adiabat. A systematic ion separation of D and T is observed in all designs. This density variation produces different ion temperatures near the hot spot center, with in particular a warmer tritium at stagnation. These temperature variations modify plasma reactivities and thus, temperatures estimated from DT and DD neutrons. A difference is also observed experimentally in many NIF cryogenic implosions, with a DT temperature systematically greater than DD temperature. In our Fokker-Planck results ion separation appears to be the major mechanism to explain such differences.