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Studies of ion species separation in ICF-relevant plasmas at OMEGA HANS RINDERKNECHT, SCOTT WILKS, PETER AMENDT, STEVE ROSS, HYE-SOOK PARK, Lawrence Livermore National Laboratory, MARIA GATU JOHNSON, JOHAN FRENJE, CHIKANG LI, FREDRICK SEGUIN, HONG SIO, RICHARD PETRASSO, Massachusetts Institute of Technology, MICHAEL ROSENBERG, CHAD FORREST, VLADIMIR GLEBOV, CHRISTIAN STOECKL, CRAIG SANGSTER, Laboratory for Laser Energetics, ALEX ZYLSTRA, NELSON HOFFMAN, TOM KWAN, Los Alamos National Laboratory, OLIVIER LARROCHE, CEA — Plasmas produced in high-energy density (HED) and inertial confinement fusion (ICF) experiments generally contain multiple ion species, which allows for multiple-ion species dynamics that are not simulated in typical single-ion fluid hydro codes. In implosions of D^3He-gas filled thin-glass spheres on the OMEGA laser facility, comprehensive nuclear diagnostics were used to infer the composition of the fuel during nuclear production, demonstrating that the deuterium fraction was reduced during the implosion of the fuel. Hydrodynamic simulations including an ion diffusion model indicate that pressure, temperature, and potential gradients drive diffusive separation of the ion species, producing better agreement with the experiments than standard hydrodynamic codes. The results of fully kinetic (Vlasov-Fokker-Planck and PIC) simulations confirm the importance of multi-species dynamics to the evolution of these experiments. Implications for multi-species (DT) cryogenic implosions on the National Ignition Facility will be addressed. This work was partially supported by the US DOE, NLUF, LLE, and GA.

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