HYDRODYNAMIC STABILITY AND TI-TRACER DISTRIBUTION IN OMEGA DIRECT-DRIVE IMPLOSIONS

T. R. Joshi[1], R. C. Mancini[1], D. C. Mayes[1], T. Nagayama[1a], R. Tommasini[2], J. A. Delettrez[3], S. P. Regan[3]

[1]Physics Department, University of Nevada, Reno, NV, USA

[2]Lawrence Livermore National Laboratory, Livermore, CA, USA

[3]Laboratory for Laser Energetics, University of Rochester, Rochester, NY, USA

tjoshi@unr.edu

We discuss the hydrodynamic stability of low-adiabat OMEGA direct-drive implosions based on results obtained from Ti emission and absorption spectroscopy. The targets were deuterium filled, warm plastic shells of varying thicknesses and filling gas pressures with a submicron Ti- doped tracer layer initially located on the inner surface of the shell. The spectral features from the titanium tracer are observed during the deceleration and stagnation phases of the implosion, and recorded with a streaked crystal spectrometer and three gated, multi-monochromatic x-ray imager (MMI) instruments fielded along quasi orthogonal lines-of-sight. Both streaked and gated data show simultaneous emission and absorption spectral features associated with titanium K- shell line transitions but only the MMI data provides spatially resolved information. The arrays of spectrally resolved images recorded with MMI were processed to obtain narrow-band images and spatially resolved spectra characteristic of annular contour regions on the image[1-4]. A multi- zone spectroscopic analysis of the annular spatially resolved spectra produce plasma conditions in the core and the spatial distribution of tracer atoms. In turn, the Ti atom distribution provides direct evidence of Ti tracer penetration into the core and thus of the instability of the shell. Additional evidence of Ti penetration is provided by Abel inversion of narrow-band image intensity profiles. Results and trends are discussed as a function of target shell thickness and filling pressure, and laser pulse shape.

Work supported by DOE/NLUF Grant DE-NA00002267, and LLNL.

[a] Present address: Sandia National Laboratories.

[1] T. Nagayama, R. C. Mancini, R. Florido, R. Tommasini, J. A. Koch, J. A. Delettrez, S. P. Regan and V. A. Smalyuk, Journal of Applied Physics **109**, 093303 (2011).

[2] T. Nagayama, R. C. Mancini, R. Florido, D. Mayes, R. Tommasini, J. A. Koch, J. A. Delettrez, S. P. Regan and V. A. Smalyuk, Physics of Plasmas **19**, 082705 (2012).

[3] T. Nagayama, R. C. Mancini, R. Florido, D. Mayes, R. Tommasini, J. A. Koch, J. A. Delettrez, S. P. Regan and V. A. Smalyuk, Physics of Plasmas **21**, 050702 (2014).

[4] R. C. Mancini, H. M. Johns, T. Joshi, D. Mayes and T. Nagayama, S. C. Hsu, J. A. Baumgaertel, J. Cobble, N. S. Krasheninnikova, P. A. Bradley, P. Hakel, T. J. Murphy, M. J. Schmitt, R. C. Shah, I. L. Tregillis, and F. J. Wysocki, Physics of Plasmas **21**, 122704 (2014).