MEASURING THE ELECTRON TEMPERATURE IN NON-LTE LASER PRODUCED PLASMAS USING K-SHELL SPECTROSCOPY AND THOMSON SCATTERING

G. V. Brown[1], M. Foord[1], D. H. Froula[2], R. F. Heeter[1], J. Katz[2], D.A. Liedahl[1], C. W. Mauche[1], J. S. Ross[1], M.B. Schneider[1], K. Widmann[1], G. W. Collins[1]
[1]Lawrence Livermore National Laboratory, Livermore, CA, USA
[2]Laboratory for Laser Energetics, Rochester, NY, USA
gregbrown@llnl.gov

We have measured K-shell x-ray spectra from highly charged ions of vanadium and iron emitted from high energy density (HED) laser produced plasmas. The plasmas were created using the Omega-60 laser at the University of Rochester's Laboratory for Laser Energetics. The laser was incident from both sides onto a flat target with a total laser intensity of ~ 4 x 10^{14} W/cm^2. The target was a sub-micron thick 200 x 200 μm^2 sample buried in the center of a 600 μm diameter, 10 μm total thickness beryllium-tamper. The sample consisted of co-mixed iron and vanadium. Time-resolved x-ray spectra were measured at electron densities of ~ 10^{21} cm^{-3}. The intensity ratio of the helium-α complexes in iron relative to vanadium, of the helium-β complexes, and of the helium-β to $1s3pn\ell \rightarrow 1s^2 2s$ dielectronic recombination satellite lines were used to derive an electron temperature based on the SCRAM model. We compare the temperature derived from these ratios with those derived from the simultaneous fits of the vanadium and iron K-shell spectra using SCRAM, and from simultaneously measured Thomson scattering data where available. These data are being used to characterize the accuracy and reliability of the K-shell spectroscopic and Thomson scattering electron temperature diagnostics in HED plasmas that are relevant to those found in ignition hohlraums.

LLNL-ABS-669985 This work was performed under the auspices of the U.S. Department of Energy by LLNL under Contract DE-AC52-07NA27344.