Ni-lined Capsules as Backlighters for Multiple Measurements in High-energy-density Physics Experiments*

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Capsule implosions are bright sources of continuum x-rays that are used in high-energy-density (HED) experiments for absorption measurements. It is common in HED experiments to have a single primary measurement, which limits the amount of information one can extract out if the already limited available experiment time. An x-ray source with useful continuum and line emission would allow for the combination of absorption measurements and scattering or fluorescence measurements.

To accomplish this, a plastic (CH) capsule had a layer of Ni on the interior surface. This will create a hot, dense Ni plasma that will produce bremsstrahlung emission. The Ni plasma will also have an optically thin layer at the outer surface that will allow line emission to escape. The CH layer is 7 μm thick, the Ni layer is 0.2 μm thick, and the outer diameter of 870 μm. This design has the same mass as standard CH capsules at the Omega laser facility at the laboratory for laser energetics, which means the Ni capsules should have similar implosion characteristics. Radiation hydrodynamics experiments in the HELIOS-CR 1D Lagrangian code confirm this.

Recent experiments demonstrated the effectiveness of Ni-lined capsules for use in experiments. Time-integrated spectra show the continuum spectra in the 2-4 keV range and the Ni line emission in the 5-8 keV. The data shows strong continuum emission and some line emission, which is a promising first result with this new capsule design. Comparisons of the data to simulations shows good agreement with the timing of the x-ray flash.

* This work is funded by the U.S. Department of Energy NNSA Center of Excellence under cooperative agreement number DE-NA0003869, and the National Laser User Facility Program, grant number DE-NA0002719, and through the Laboratory for Laser Energetics, University of Rochester by the NNSA/OICF under Cooperative Agreement No. DE-NA0003856.