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Quantitative Dopant/Impurity Analysis for ICF Targets HAIBO HUANG, ABBAS NIKROO, RICHARD STEPHENS, General Atomics, SAMUAL EDDINGER, HONGWEI XU, K.C. CHEN, KARI MORENO, General Atomics —
We developed a number of new or improved metrology techniques to measure the spatial distributions of multiple elements in ICF ablator capsules to tight NIF specifications (0.5±0.1 at% Cu, 0.25±0.10 at% Ar, 0.4±0.4 at% O). The elements are either the graded dopants for shock timing, such as Cu in Be, or process-induced impurities, such as Ar and O. Their low concentration, high spatial variation and simultaneous presence make the measurement very difficult. We solved this metrology challenge by combining several techniques: Cu and Ar profiles can be nondestructively measured by operating Contact Radiography (CR) in a differential mode. The result, as well as the O profile, can be checked destructively by a quantitative Energy Dispersive Spectroscopy (EDS) method. Non-spatially resolved methods, such as absorption edge spectroscopy (and to a lesser accuracy, x-ray fluorescence) can calibrate the Ar and Cu measurement in EDS and CR. In addition, oxygen pick-up during mandrel removal can be validated by before-and-after CR and by density change. Use of all these methods gives multiple checks on the reported profiles.

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