METROLOGY DEVELOPMENT FOR NIF TARGET CHARACTERIZATION[1]

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As the National Ignition Facility (NIF) has matured into a user facility for high energy density (HED) science and stockpile stewardship program that handles increased target variety, complexity and quantity, the Inertial Fusion Technology Division of General Atomics, as a major target supplier, has put in significant effort to upgrade target metrology capability and efficiency, so that these targets can be quantified to stringent standards required for delivery on tight schedules. This presentation highlights a few areas of recent improvements. For example, PAMS and GDP mandrels are culled by an automated batch scanning microscope for isolated defects. Spheremappers have been upgraded to High Density (HD) for 25x better spatial resolution to resolve sub-micron defects on High Density Carbon (HDC) and beryllium capsules, and a new Automated Spheremapper was built to robotically automate sample loading and alignment for batch measurement. A Leica 4Pi system was used to produce surface maps on defects too small or too steep to be measured by interferometers. The resultant surface maps and defect statistics can be used to predict capsule performance through a growth factor calculation that can be validated in NIF experiments. This instrument has also been integrated with a pulse laser such that big surface defects can be removed by laser ablation and diagnostic ripple patterns can be written onto the shell surfaces. X-ray tomography capability has been enhanced to analyze voids and high-Z particles in HDC capsules for process optimization. A combination of x-ray absorption Edge spectroscopy (Edge) and X-Ray Fluorescence (XRF) spectroscopy has been used to analyze new target platforms in which multiple-element thin films are used to diagnose the target implosion process.

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