Developing depleted uranium and gold cocktail hohlraums for the National Ignition Facility

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Abstract

Fusion ignition experiments are planned to begin at the National Ignition Facility (NIF) [J.A. Paisner, E.M. Campbell, and W.J. Hogan, Fusion Technol. **26**, 755 (1994)] using the indirect drive configuration [J.D. Lindl, P. Amendt, R.L. Berger, S.G. Glendinning, S.H. Glenzer, S.W. Haan, R.L, Kauffman, O.L. Landen, and L.J. Suter, Phys. Plasmas, **11**, 339 (2004)]. Although the x-ray drive in this configuration is highly symmetric, energy is lost in the conversion process due to x-ray penetration into the hohlraum wall. To mitigate this loss, depleted uranium is incorporated into the traditional gold hohlraum to increase the efficiency of the laser to x-ray energy conversion by making the wall more opaque to the x-rays [H. Nishumura, T. Endo, H. Shiraga, U. Kato, and S. Nakai, Appl. Phys. Lett. **62**, 1344 (1993)]. Multi-layered depleted uranium (DU) and gold hohlraums are deposited by sputtering by alternately rotating a hohlraum mold in front of separate DU and Au sources to build up multi-layers to the desired wall thickness. This mold is removed to leave a freestanding hohlraum half; two halves are used to assemble the complete NIF hohlraum to the design specifications. In practice exposed DU oxidizes in air and other chemicals necessary to hohlraum production, so research has focused on developing a fabrication process that protects the U from damaging environments. This paper reports on the most current depleted uranium and gold cocktail hohlraum fabrication techniques, including characterization by Auger electron spectroscopy, which is used to verify sample composition and the amount of oxygen uptake over time.

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