

Fabrication of Graded Germanium-doped CH Shells*

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One of the capsule designs for achieving ignition on the National Ignition Facility (NIF) is a 2mm diameter Ge-doped CH shell that has a 160μm thick wall. The Ge doping is not uniform, but rather is in radial steps. These steps are made by controlled addition of various levels of (CH₃)₄Ge to the gas stream in the GDP coater. These GDP shells need to meet low germanium doping concentrations, layer thickness and surface finish requirements.

We determined the germanium doping concentrations and coating rates by performing tryout runs and characterized them with X-ray fluorescence, neutron activation analysis, and X-ray contact radiograph simulations, with good agreement between the methods being demonstrated. The layer thickness and concentrations of the final multi-layered shells were determined destructively by SEM cross-sectioning and non-destructively by X-ray contact radiography and simulation.

The four-layered graded-Ge capsule, which meets NIF design parameters, has an inner 10μm undoped GDP layer, followed by a 48μm-thick layer of 0.83 at. % Ge-doped GDP, an 10μm layer of 0.38 at. % Ge-doped GDP and then 90μm of undoped GDP. The surface quality of the shell, characterized with AFM, shows the power spectrum meets the relaxed NIF standard.

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