Target Fabrication Advances at Gryphon Schafer Livermore Laboratory


23rd Target Fabrication Meeting
Annapolis, MD
Apr 23, 2019
SCHAFTER LIVERMORE LAB. HAS BEEN ACQUIRED BY GRYPHON TECHNOLOGIES

- We are no longer affiliated with Belcan
- We’re still the same fun-loving bunch that you all know and love
- There is no change in our commitment to providing targets
Two topics

1. Interesting targets developed, fabricated, and delivered

2. Work in progress: increased capabilities in response to target requests
The MJDD* campaigns study feasibility of NIF for direct-drive ICF

- LLE led collaboration
- Campaign of planar and spherical experiments
- One of the key issues is imprint

*MJDD – MegaJoule Direct Drive
**Imprint Target**

Target separation and geometry determined by beam interference

*MJDD – MegaJoule Direct Drive*
“Dot” location and size are important.

Material: Si

4X Si Microdots
See DETAIL A.

DETAIL A
Scale 1000 : 1
Planar Imprint Target

- Silicon features are to specification
- The rest of CH film featureless
Planar Imprint Foil
Planar Imprint Target
Challenge: create a cylindrical CH cup with a thin, tailored wall thickness profile (20 - 50 um thickness)

See Poster: Letts et al., “Fabrication of Cylindrical Structures using GDP coating on Mandrels”
OHRV & Foam Imprint Targets

Washer-Film Design (mm)

Aerogel

Washer/Film

Assembly

See poster by Streit, Bennett, et al. “Fabrication of Machined Foam-Film Assemblies for Laser Imprint Reduction”
Schafer/UNL provides precision target components “printed” using 2-Photon Polymerization ("2PP")

Example: low density foam for NRL

Process development is also continuing
Work in Progress
Physics packages with metal oxide films

An example: Iron oxide

- But there are several varieties, none of which come as pure thin films

FeO - Wustite
Fe₃O₄ - Magnetite
Fe₂O₃ - Hematite

Increasing oxidation levels
Initial results from e-beam evaporation of Fe in O\textsubscript{2} background onto glass substrate look promising

• By appearance it’s a clear transparent layer of Fe\textsubscript{2}O\textsubscript{3}

• Measured index of refraction is consistent with full bulk density

• \textit{However}, the desired material is FeO

Can O\textsubscript{2} background pressure be adjusted to give FeO?
• At chamber residual pressure (mid 10\textsuperscript{-7} Torr), get pure Fe
• At \sim{} few x 10\textsuperscript{-4} Torr, get Fe\textsubscript{2}O\textsubscript{3}
• Work in progress
**2nd approach: Oxidation of pure Fe coated layers**

- PVD pure Fe onto substrate
- Furnace oxidize
- Oxidation rates determined from weight gain

**However:**
- The phase stability diagram is complex
- Notice that stoichiometric FeO is not a stable phase
- We are experimentally assessing the effects of temperature and atmospheric composition to give FeO

![Graph showing oxidation rates and phase stability diagram for FeO]
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