Layering and Characterization of Cryogenic DT Targets for OMEGA


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Smooth DT-ice layers (<1-μm rms) are repeatedly produced for OMEGA cryogenic targets

- **DT targets β layer with rms < 1 μm**
  - start from single-seed crystal
  - layer slowly over a temperature range of 45 mK
  - reached the point where a significant portion of the bright-ring rms may be caused by perturbations on the outer surface, not the inner-ice surface

- **DT layers appear to be unchanged by exposure to the OMEGA chamber prior to implosion**
  - layer unchanged for \( t \leq 10 \text{ s} \) during exchange-gas vent
  - no melting is observed in images ~30 ms before shots
Growing an ice layer from a single-seed crystal is essential to forming a smooth layer.

Flash frozen – 8.4-\(\mu\)m rms

Formed from a single crystal – 0.47-\(\mu\)m rms in a single view

Supercooling leads to many ice crystals.

![Graphs showing mode versus \(P(\mu m^2)\) for different rms values.](image)
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Reproducibility of layering protocol is encouraging for layering opaque targets.
The presence of He in the gas void had little effect on the layer quality.

$^{3}\text{He}$ accumulation: 11 Torr
$1.5-\mu\text{m rms}$

D:T:$^{3}\text{He} \cong 1:1:1/8$

$^{3}\text{He}$ accumulation: 80 Torr
$1.3-\mu\text{m rms}$

D:T:$^{3}\text{He} \cong 1:1:1$
Four DT ice layers with an ice roughness $<1\mu m$ rms over the entire surface for all modes have been produced.

The outer-shell roughness may dominate the bright-ring rms in these targets.

- Ice-surface rms may actually be significantly less than apparent.
- Ray-trace studies are underway to separate outer- and inner-surface effects on the bright ring.
The quality of the ice layer at shot time is determined by the time the target is without sufficient He exchange gas.

- Before removing the shrouds to expose the target, the He exchange gas is vented from around the target.
  - ~ few seconds to clear He from target chamber
- This allows the ice to warm at a rate of 1 K/15 s and slump at a rate of ~1 μm/s after ~5 s.
Pre-shot images show no indication of DT layer slumping

Exposure: ~0.5 msec within 30 msec of shot time
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