LiF Fabrication and Physics Package Assembly for NIF EOS Targets

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Abstract

LiF material is used in target fabrication to construct physics packages for National Ignition Facility (NIF) Equatorial 50-cell (site 225) targets. LiF material is shaped and then polished to create thin or thick sections to be inserted into the target assembly. LiF packages are constructed by machining or etching individual LiF sections. The assembly is mated to other physics packages and non-LiF materials, which are fabricated independently of the analysis of the data science during the target assembly. Assembly can be challenging when the parts are too small or out of specifications.

Processing and Assembly Challenges

- Edge Polish
  - Initial polish: Raw material (25mm diameter x 3mm thick) is polished to desired thickness (between 60-120 micron final polish required).
  - Edge polish: Remove 25% of material from front edges to maximize usable area per piece uniformly.
  - Final polish: Polishing leaves a 3 micron deep edge. Top and bottom surfaces are lightly polished to remove 25-30mic.

- Dicing Parts
  - A 125 micron chipping edge is used to dicing, with a diamond blade.
  - Over-sized pattern is used, allowing for 10% error.

- Part Form
  - Uniform layer of glue is used to achieve flat surfaces. Parts undergo a 3 micrometre tolerance on thickness.

- Assembly Form
  - After gluing parts together, the parts are changing shape, typically forming a 3-4 micron cause to travel space.

Initial Polish

- Raw LiF material (50mm diameter x 3mm thick)
- Initial polish to desired thickness

Final Polish

- Parts polished: Grit: 3000, 1500, 800, 400, 250, 150, 100, 50
- Parts polished: Grit: 2000, 1000, 500, 250, 120

Diamond Turning

- Parts turned: 60% of material is removed, leaving 100 micron surface finish.

Part Assembly

- Parts polished: 80% of material removed, leaving 50 microns surface finish.

Assembly Form

- 4 steps of polishing are required to achieve the desired thickness.

Continued Investigation

- LiF and Cu parts are flat in form before glue assembly.
- Glue application shows a significant form change.
- Glue application and glue gap thickness is successful.
- LiF cutting and polishing produces precise parts.
- Parts are analyzed for thickness uniformly across the whole surface.
- Tolerance of glue is being investigated for shrink effect on assembly.
- Specification requirements for part form is being investigated.

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