Design Parameters for CVD Shrapnel Tiles

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CVD-2B Shrapnel Tiles

• **Purpose**
  – The purpose of the ceramic tiles will be to cover the inside wall of a spherical firing vessel and thus protect the inner liner from shrapnel

• **Design Constraints**
  – Select appropriate geometric shape, material and manufacturing processes for shrapnel mitigating ceramic tiles
  – Tiles must fit thru port openings
  – Tiles must conform to inner spherical or elliptical radius
  – Minimize the number of different tile sizes
  – Minimize total number of tiles
  – Minimize cost
  – Tiles must be assembled from the inside

• **Vessel Dimensions**

<table>
<thead>
<tr>
<th>CVD-2B Vessel</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Port Openings</td>
<td>11.500” Diameter</td>
</tr>
<tr>
<td>Inner Spherical Liner</td>
<td>18.637” Radius</td>
</tr>
<tr>
<td>Liner Material</td>
<td>Alum 2219-T6</td>
</tr>
</tbody>
</table>
CVD-2B Shrapnel Tiles

• **Design Option #1**
  - 5 rows of tiles
  - 3 sizes of tiles
  - 12x 30° apart for each row
  - Total tiles = 60
  - Equatorial tile spans weld joint at vessel waist
  - Tiles ‘stack’ on horizontal edges
  - Tiles inter-lock radially with beveled edges
  - Design #1 assumes friction stir-weld step is machined off
CVD-2B Shrapnel Tiles

• **Design Questions**
  1. Can the tiles be manufactured from these five material choices: B₄C, SiC, Al₂O₃, TiB₂ and Pyrex
  2. Can the tiles be easily manufactured into the shapes shown on the detail drawings
  3. For the ceramic tiles, which Pressing Process would be used: Dry, Cold Isostatic, Hot, Hot Isostatic
  4. What type of mold design would be required, ie, Graphite or Steel molds; design limits on molds
  5. Expected % of shrinkage after Firing process
  6. What is high cost driver in the manufacturing process: Shape of tile, Thickness to Length ratio, Tolerances, Final Machining or Post Surface Finishing
  7. What else…?
CVD-2B Shrapnel Tiles

Design Option #1

Shrapnel tiles bonded inside Firing Vessel

Level 2 Tiles

Level 1 Tiles

Equatorial Tiles

Friction Stir-Weld Joint
CVD-2B Shrapnel Tiles

Design Option #1
Tile assembly without Vessel
CVD-2B Shrapnel Tiles

ISO VIEW
SCALE 1/2

NOTES
UNLESS OTHERWISE SPECIFIED:
1. ALL DIMENSIONS ARE IN INCHES.
CVD-2B Shrapnel Tiles
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CVD-2B Shrapnel Tiles

NOTES
UNLESS OTHERWISE SPECIFIED:
1. ALL DIMENSIONS ARE IN INCHES.
2. DIMENSIONING AND TOLERANCING PER
   SURFACE TOLERANCE SYMBOLS PER ANSI
4. FINISH: 125 MICROINCHES ALL OVER.
5. EDGES ARE GREAT CIRCLES.
6. PART CREATED FROM THE FOLLOWING
   MOLD COMPONENTS:
   MALE MOLD, UPPER
   FEMALE MOLD, LOWER
7. ESTIMATED VOLUME: 32.6 INCH³
8. MANUFACTURE PER THE FOLLOWING PROCEDURE:
   A.
   B.
   C.
   GLASS SHALL BE WRAPPED IN TISSUE,
   OVERWRAPPED WITH CUSHIONING MATERIAL
   AND SECURED WITH TAPE.
9. BAG AND TAG WITH PART NUMBER.

ISO VIEW 1
INNER SURFACE
SCALE 1:1

ISO VIEW 2
OUTER SURFACE
SCALE 1:1

PRELIMINARY
FOR INTERNAL USE ONLY
NOT FOR DISTRIBUTION
SUPPLEMENTARY MATERIAL

UCRL-TR-201986
CVD-2B Shrapnel Tiles
CVD-2B Shrapnel Tiles

NOTES

UNLESS OTHERWISE SPECIFIED:
1. ALL DIMENSIONS ARE IN INCHES.
   Surface Texture Symbols PER ANSI
4. FINISH: 125 MICROINCHES ALL OVER.
5. EDGES ARE GREAT CIRCLES.
6. PART CREATED FROM THE FOLLOWING
   MOLD COMPONENTS:
   MALE MOLD, UPPER AA43-X X X X X
   FEMALE MOLD, LOWER AA43-X X X X X
7. ESTIMATED VOLUME: 9.2 INCHES
8. MANUFACTURE PER THE FOLLOWING PROCEDURE:
   1.
8. GLASS SHALL BE WRAPPED IN TISSUE
   OVERWRAPPED WITH CUSHIONING MATERIAL
   AND SECURED WITH TAPE.
9. BAG AND TAG WITH PART NUMBER.
CVD-2B Shrapnel Tiles