

Beryllium material properties and dimensional constraints

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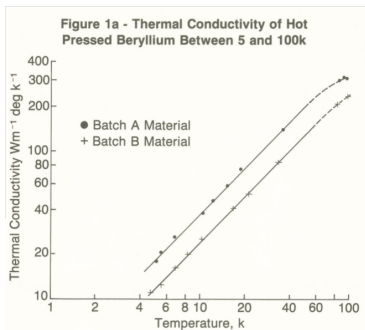
At our last meeting, we agreed that we needed some more specific information about Be window fabrication. I've spoken with two Be vendors to determine what's possible and what's plausible in this regard:

- The Cullmal, AL branch of **General Dynamics** won the contract for the modular cavity's Be windows.
- **Materion Electrofusion** (formerly Brush-Wellman) in Fremont, CA made the curved MICE 201 MHz windows.

I've posted tech notes about some of the relevant material properties.

What about material properties?

See the Indico site for this meeting. I've uploaded several tech notes that discuss **electrical conductivity, thermal conductivity, and linear expansion** in great, gory detail. These studies are old, but the Materion folks assure me they're still accurate.



<http://materion.com/ResourceCenter/TechnicalPapers/BerylliumMetalTechnicalPapers/ThermalProperties.aspx>

General Dynamics says. . .

- Their plates are rolled from sheet supplied by Materion. Consult them for κ , σ , etc.
- For 0.1 mm to 1.0 mm thickness, the maximum window diameter from them is **6 inches**.
- To get a curved profile, they start with a thick plate and then machine out the excess Be.

Materion says. . .

- MICE windows are 15 mil thick. Cut from 18.25" square and then hot pressed for the curved profile.
- They "pushed the limits" in brazing the Cu ring around it. The challenge here was **eliminating voids** for good, consistent RF contact.
- **No diameter is too big** for whatever thickness. Our challenge is to determine what we can get away with from a structural standpoint. (We don't need them for that.)
- Vacuum on only one side: 0.1 mm thickness requires 1.5" max. diameter.
- Pressing the pre-curved shape can open up holes at the thin spots. (c.f. pizza dough) 1 mm might be ok for hot pressing the pre-curved shape.
- Stepped thickness ok. Can also chemically etch, but we'd have to be careful about uniform thickness.
- Purity is not a problem unless we need 99.98% purity.

General information about Be fabrication from Materion

<http://materion.com/ResourceCenter/ProductData/Beryllium/BerylliumMetal/DesignGuides.aspx>