Nov. 7, 1983 Y. Gable

NOV 1983

WINDOW AND TARGET PREPARATION

R. L. Moody, 844-6977

Windows

Sapphire, Lithium Fluoride, X & Y cut quartz, Dynasil 1000 and PMMA are the common window materials at STAR. All but sapphire can be diffused on site; the sapphire being sent to area shops with diamond grit for their laps.

Two common methods of diffusing are used, and often combined. First, the windows are machine lapped for 5-8 minutes. Second, they are hand lapped (on the machine lap table) until diffuse. If the first method is used, great care must be taken to protect the non-diffused surface from the lap weight.

A small HeNe laser and a white sheet of paper are used to determine correct diffusion. At this point, it all becomes black magic. Holding the window perpendicular to the beam, with the white paper backdropping it, a diffuse pattern should be apparent. If there are lines, or exceptionally bright spots, more diffusing is needed. If an even pattern is projected, then it becomes a matter of brightness; a matter solved only by experience. NOTE: If you get one window that is just what you want, save it and use it for comparative purposes until you develop experience enough to "eyeball" the correct brightness.

Next, the windows are sent out for plating. Normally, STAR windows are plated to between 4000-7000 angstroms. Hold the window to any light, and if pinholes or lines are visible through the plating, it must be replated.

Finally, measurements are taken. Diameter and thickness are measured with micrometers to four places, i.e. 2.0356 mm. Mass is determined on

the smaller windows on a microgram balance and on a four place balance above 30 grams.

Targets

Flat targets only are discussed herein. Targets are lapped similarly to windows. Or, if the targets are already flat (supplied crystals, plates, etc.) then direct measurements are taken. If plating is necessary, then the same procedures (or those specified by the experimenter) are followed. Only one note here; if it is possible to leave the bond surface of the target as a lapped surface, it will enhance bond strength.

If you lap your target and then polish it, a nominal flatness tolerance is 1-G bands (11 micro-inches per band) on 1-2 inch diameter targets. For 2-4 inch diameter targets, a 2-10 band limit is nominal.

Target Plates

Same as targets, except 10-30 bands acceptable.

Bonding Techniques

More black magic here. There are dozens of techniques used. Two are discussed here. A target and a window are cleaned. Some sort of aligning ring that closely fits both pieces is made, always from a non-stick material. A flat plate, at least as flat as 1-5 bands, and larger diameter than the target is used. Coat the flat plate with some brand of mold release. Let it partially dry, then wipe off the excess. Place the target, bond surface up on the plate. Slip the aligning ring over the target. Hysol HD3490 hardener and RE2038 resin is used. After mixing the 4:1 preparation, outgassing for 5-8 minutes at approximately 200-500 microns is done in a bell; c.r. One drop on the surface of the window is applied. The window is then placed upon the target.

An alternate glue application is to "wet" both target and window bond surfaces by placing just enough epoxy on them to be spread over the entire area. A new razor blade is used to VERY CAREFULLY scrape off all that can be. Then one very small drop is applied the same as before.

When the window is upon the target, a suitable weight (determined by whatever will balance, and/or not crush either target or window) is placed on the window. Sometimes (read recommended highly) a buffer of some soft material is placed between the window and the weight.

An alternate method is to clamp the window to the target/flat plate assembly. Fixing a C-clamp in a vise and using some buffer between the window surface and the clamp screw, pressure is applied. How much pressure? It's a guess; one of the those "experience only" techniques.

The final assembly is measured after drying 24 hours. Nominal bond thicknesses are .001-.0001 inches. Occasionally, a "negative" bond thickness may be read. This is due to the glue eating into the target or window materials.

Gluing the assembly into the target plate is the next step. Mold release is applied to a flat plate as before. The target plate is C-clamped to the flate plate at 120° spacings. The assembly is placed in the target plate and weighted or clamped as above. Outgassing of the glue is not necessary during this stage. Twenty-four hours of curing time are needed.

Tolerances

All windows and target tolerances are at the discretion of the experimenter. Nominally, STAR uses ±.001 inches on diameter, thickness and parallelism. Alignment rings are usually ±.002-±.015 inches larger than assembly diameter and thick enough to reach the target-window interface. (But no thicker than necessary, to facilitate assembly removal.) Target

plates are the same ±.002-±.015 inches. A caution: sometimes the epoxy will expand in curing enough to cleave, crack or break some target and window materials. Again, experience dictates which tolerances can be used with which materials. Bands per inch tolerances are also discretionary. Though the above stated tolerances are strived for, on some thinner samples or materials that do not lap well, exceptions have to be made. On some materials, bands per inch cannot be read at all. If it is possible, a T.I.R. reading is made to determine the flatness.

Measurements

All measurements are taken to the limit of the measuring tool.