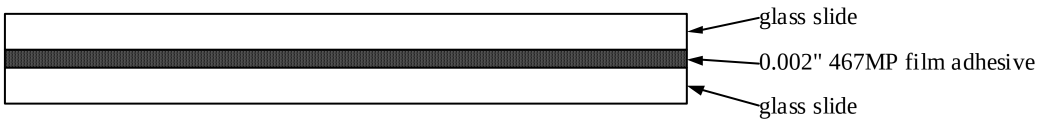
LG 10/25/2004

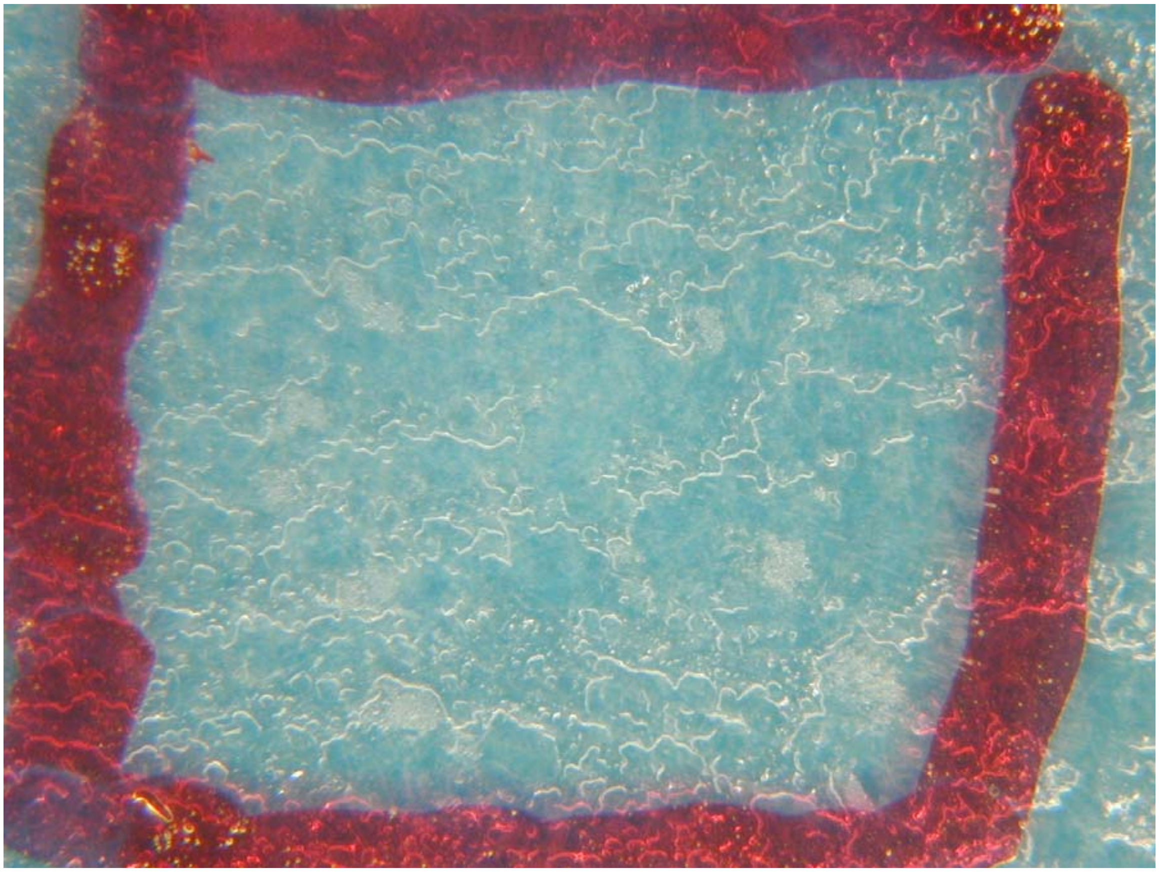
Film Adhesive Testing Progress Report

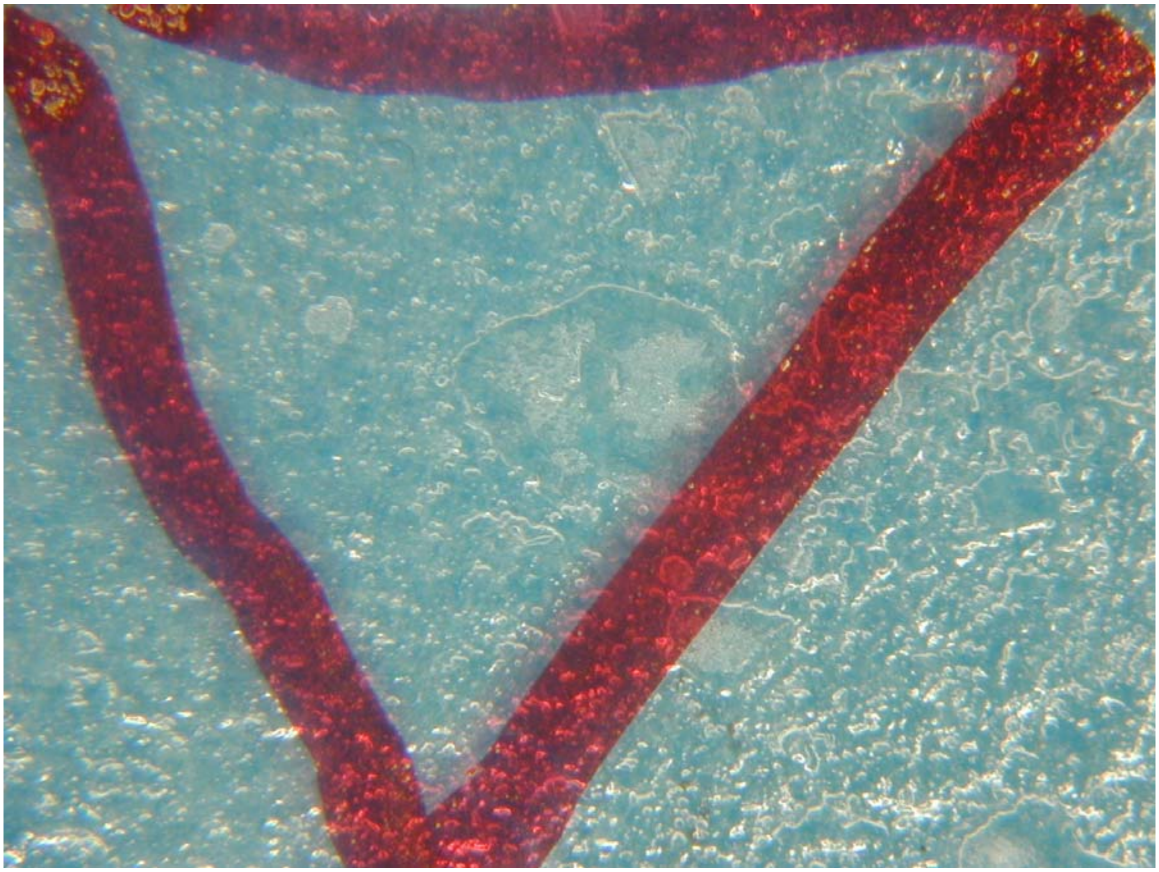
Gluing the MIMOSA detectors to the cable turns out to be quite a challenge. We do not wish to use a heat set adhesive Because of the radically different CTE between the kapton of the cable and the Silicon of the MIMOSA detectors. Also, since the thinned MIMOSA detectors need to be placed against a vacuum chuck in order to be positioned and held flat (the individual thinned detectors have a pronounced “cupping” and do not lay flat), liquid adhesives give significant risk of gluing the detectors or carrier to the positioning fixtures due to any excess adhesive. Too little adhesive could also be a problem since we need a definite glue bead under the bonding pads at the edge of the detectors to give a solid surface for bond wires to be applied.
One promising adhesive solution is acrylic based film adhesives, which do not require heat curing and have a very thin bond line (0.002” and 0.005”). We have tested some 3M type 467MP thin film laminating adhesive. More information on this product and other similar ones cane be found at http://www.lbnl.leog.org/3m_film_adhesives.pdf

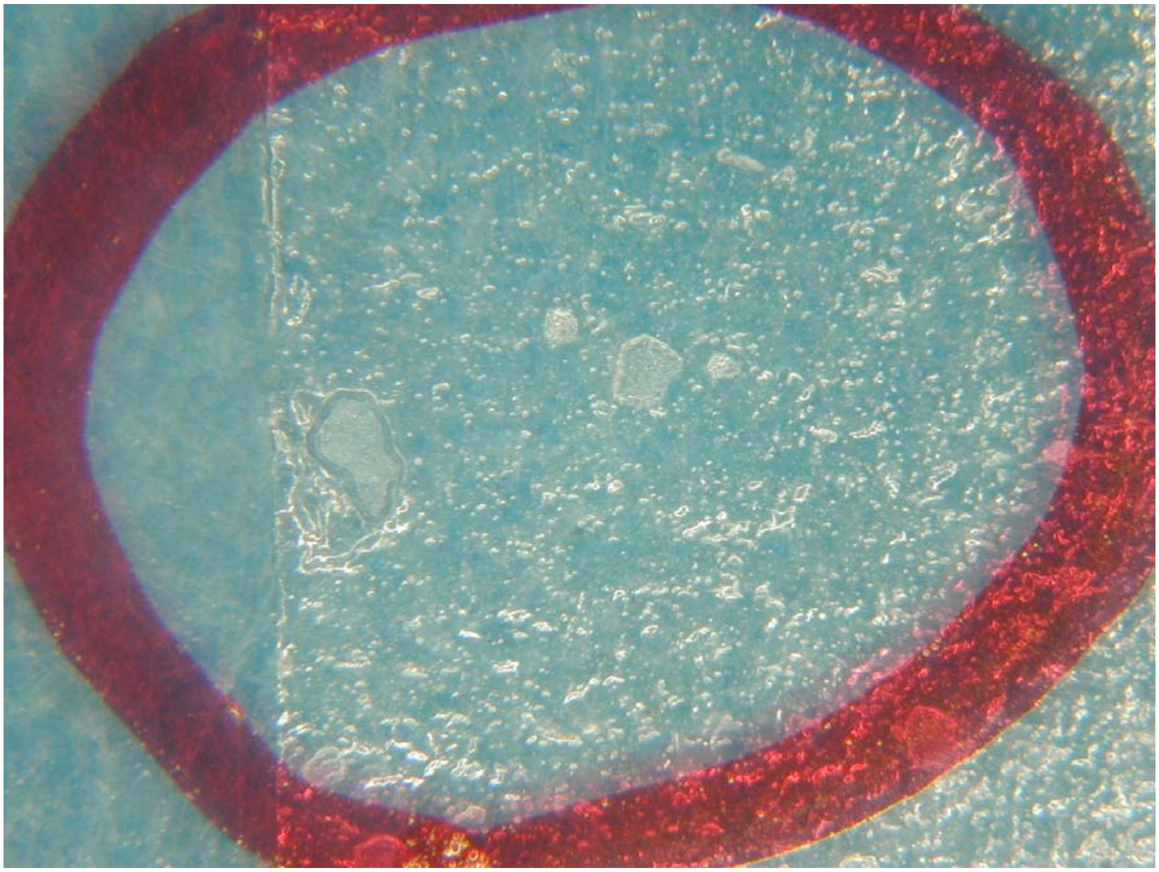
To begin, we looked at 2 glass slides glued together with this film adhesive. The glass allowed us to see the quality of the bonding joint and air bubbles.



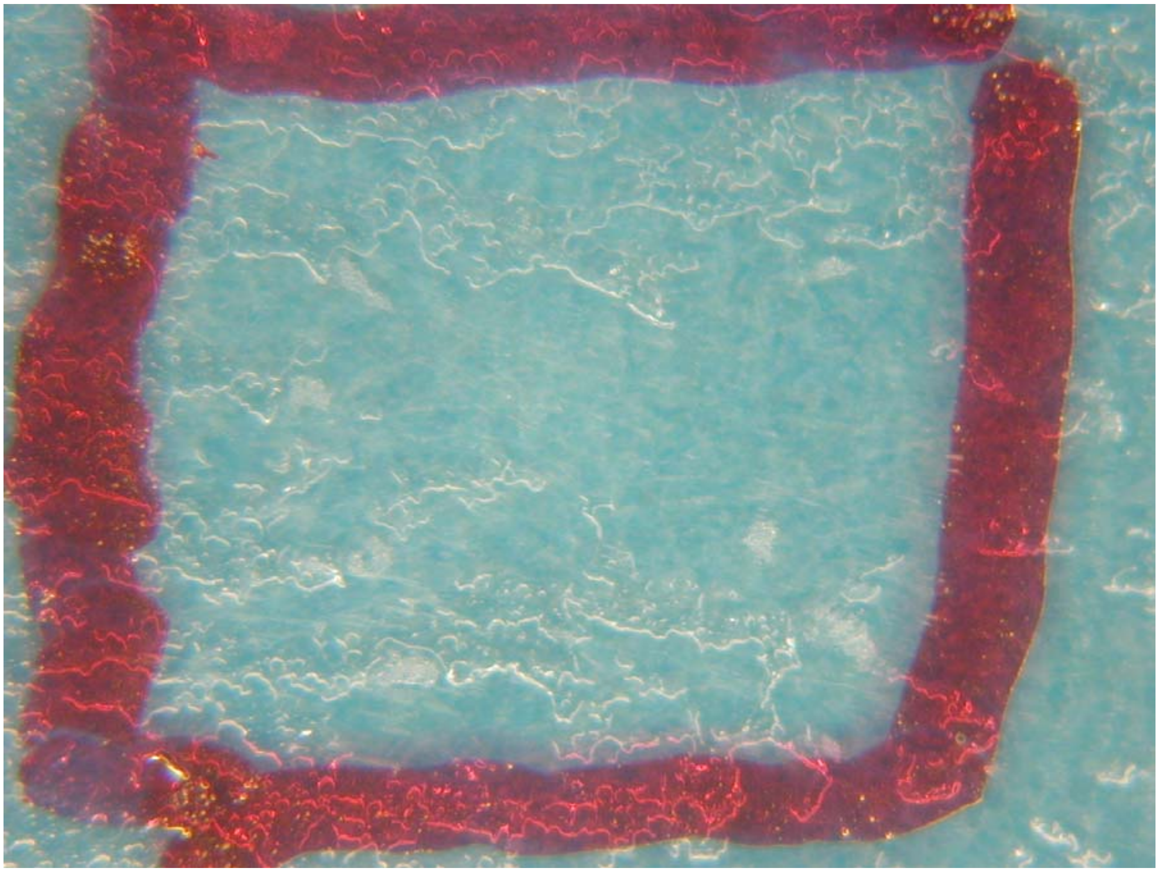
To begin, there were significant bubbles in the sandwich between the layers of glass and adhesive. Here are photographs of 3 spots. This first is a picture of the adhesive contact taken through a microscope. The size of the rectangle is ~1.0 x 0.8 cm. The next 2 are other areas used as reference spots.

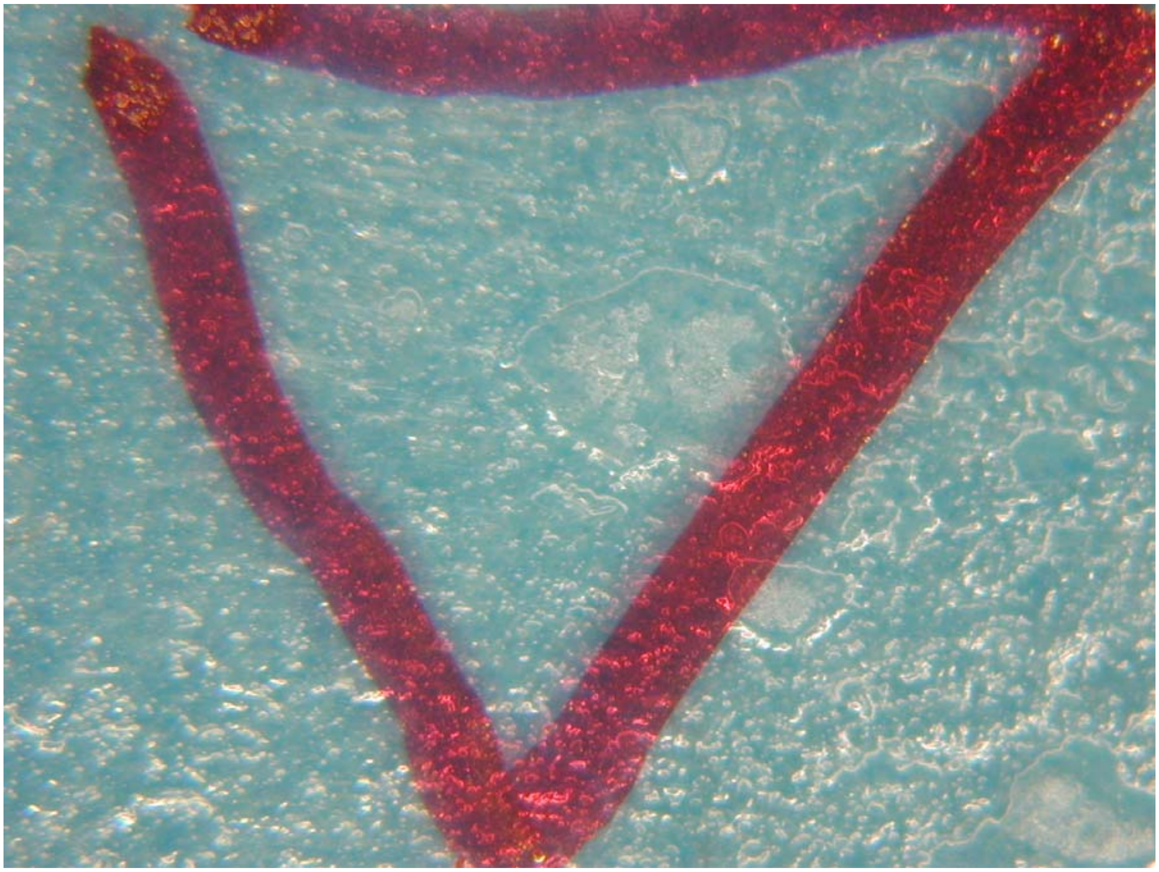

Picture 1

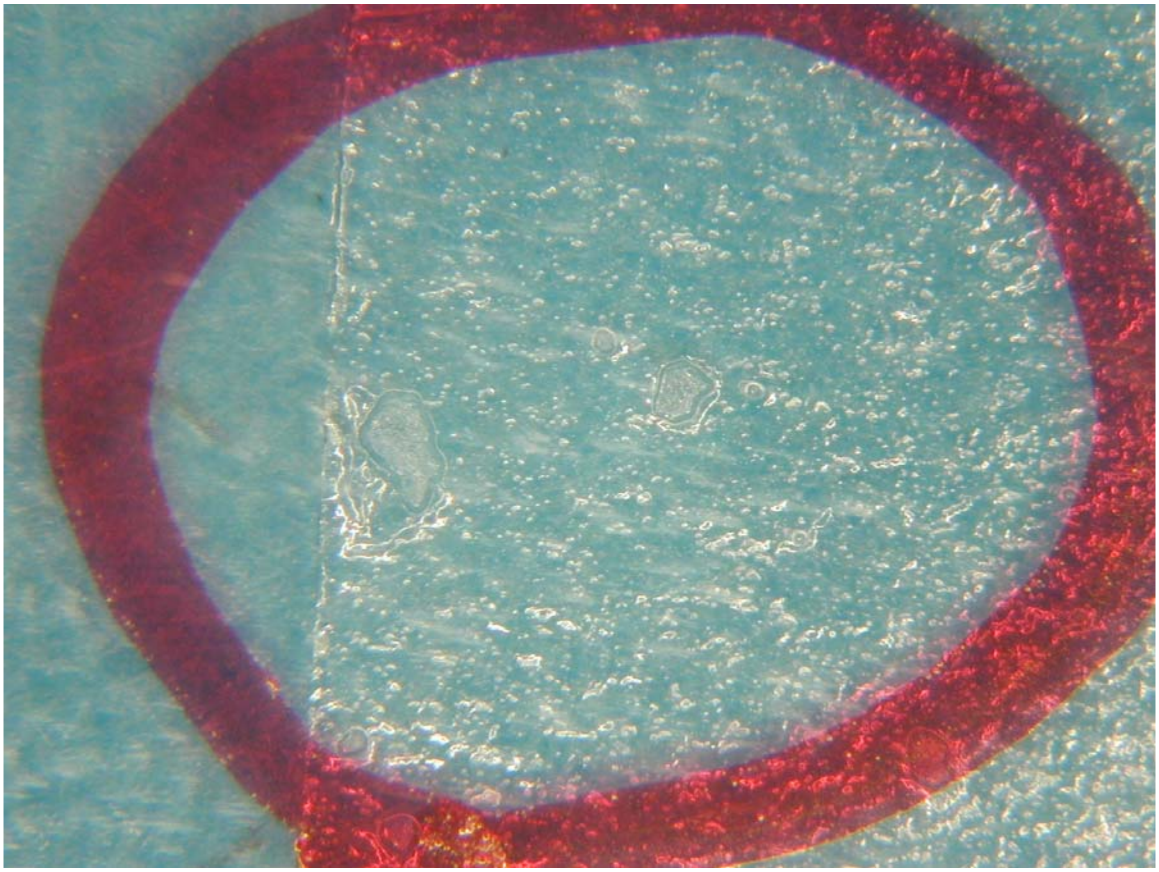

Picture 2


Picture 3

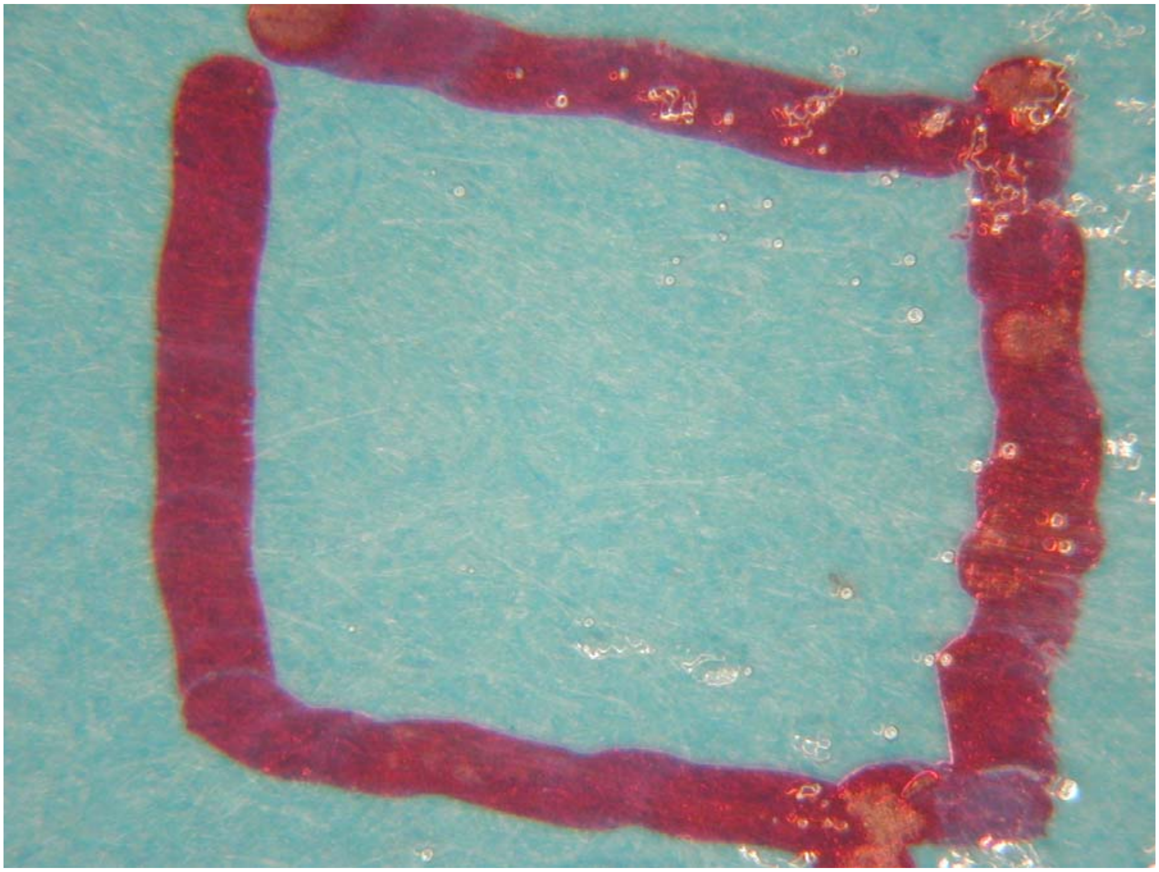
We then tried to remove the bubbles with vacuum. The sample was placed in a bell jar and pumped down to ~100 microns vacuum for ~24 hours. The pictures 4-6 are the reference areas after the vacuum treatment.

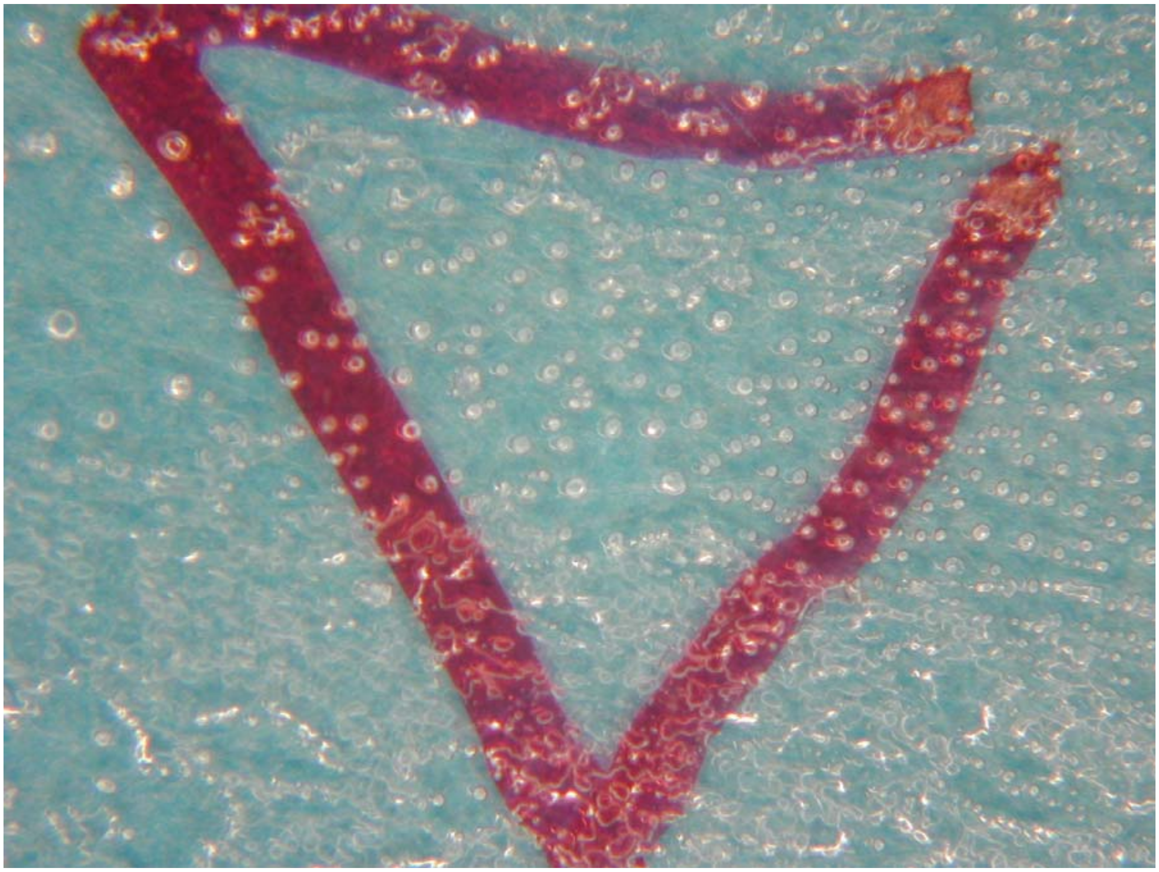

Picture 4

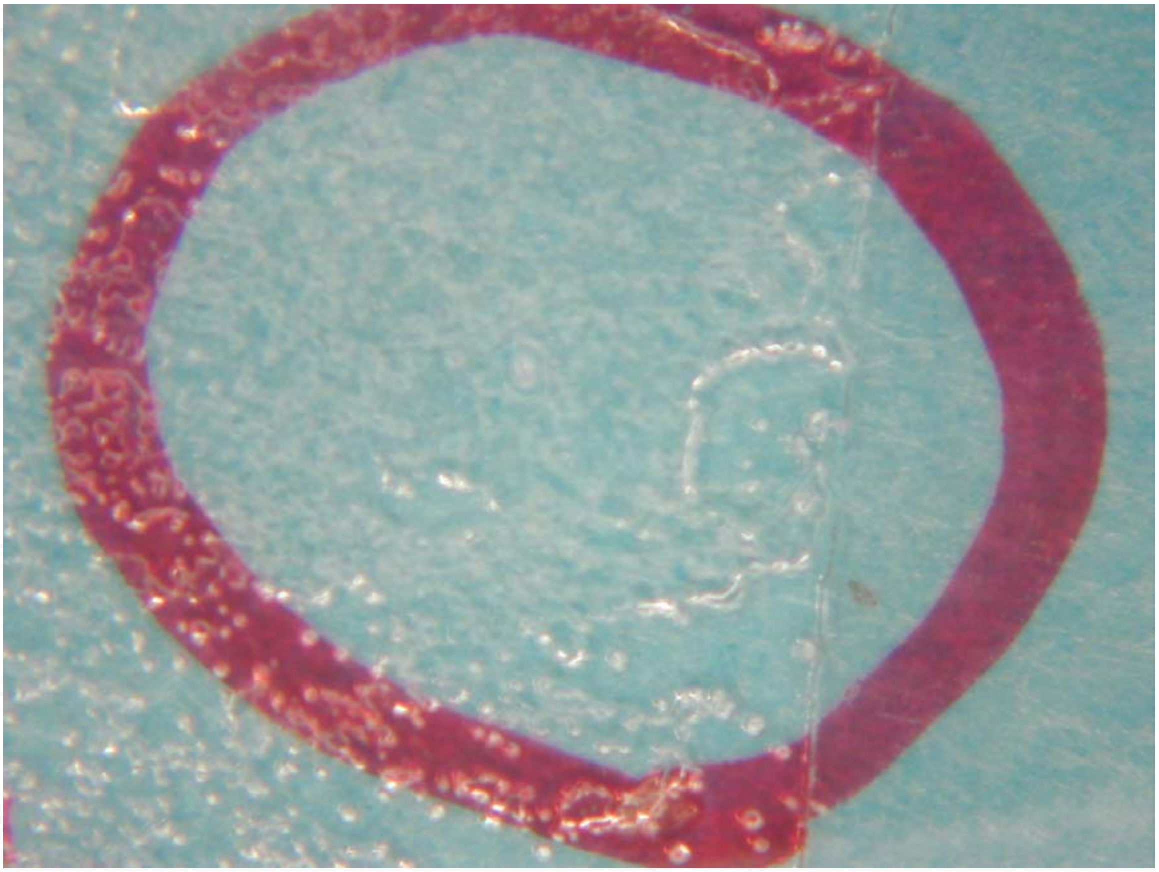

Picture 5


Picture 6

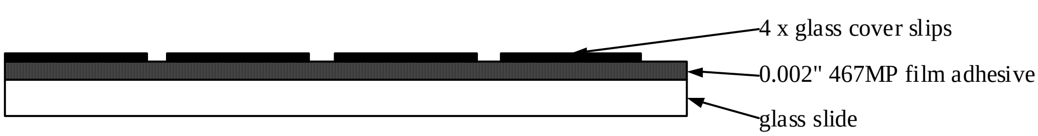
The vacuum process doesn't seem to help the adhesion significantly. We then tried putting the bond under pressure. The assembly was pressurized with air to 60 psig for ~16 hours. Pictures 7-9 below show the results.


Picture 7

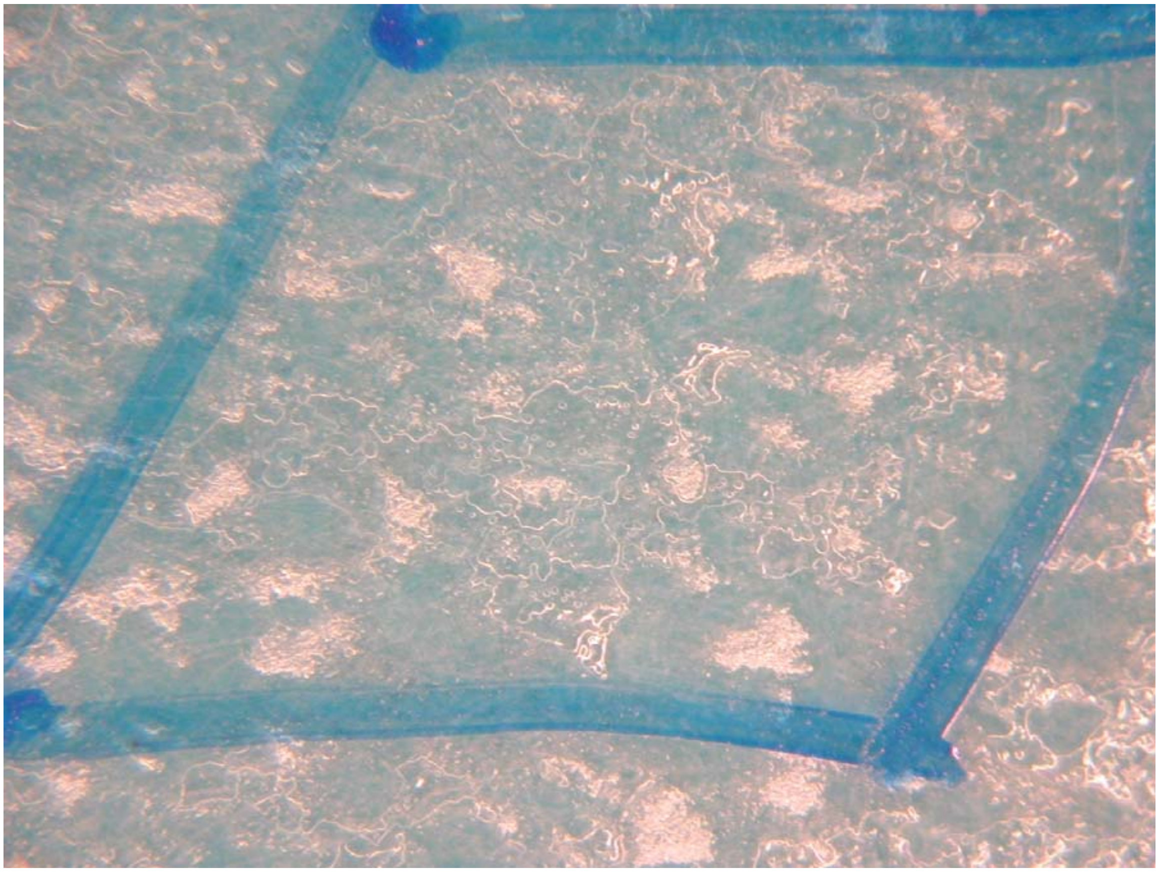

Picture 8

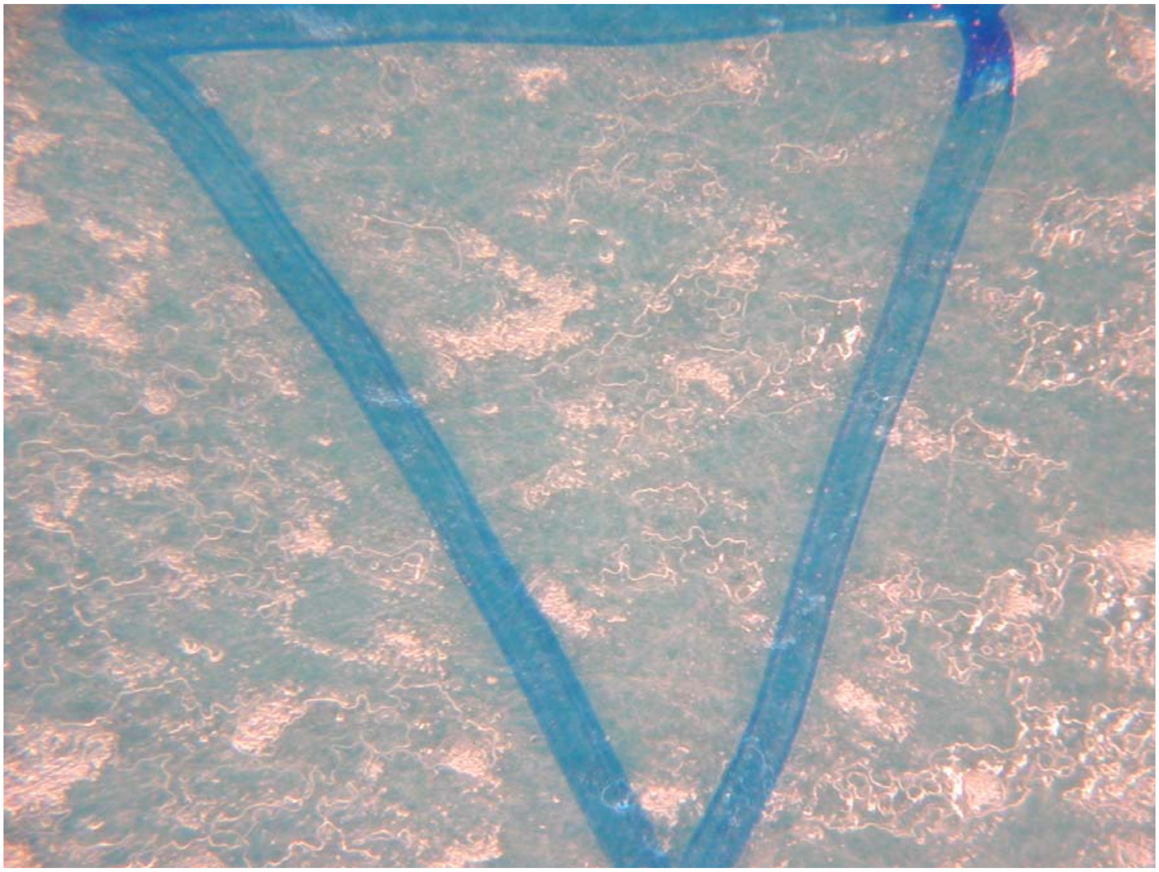

Picture 9

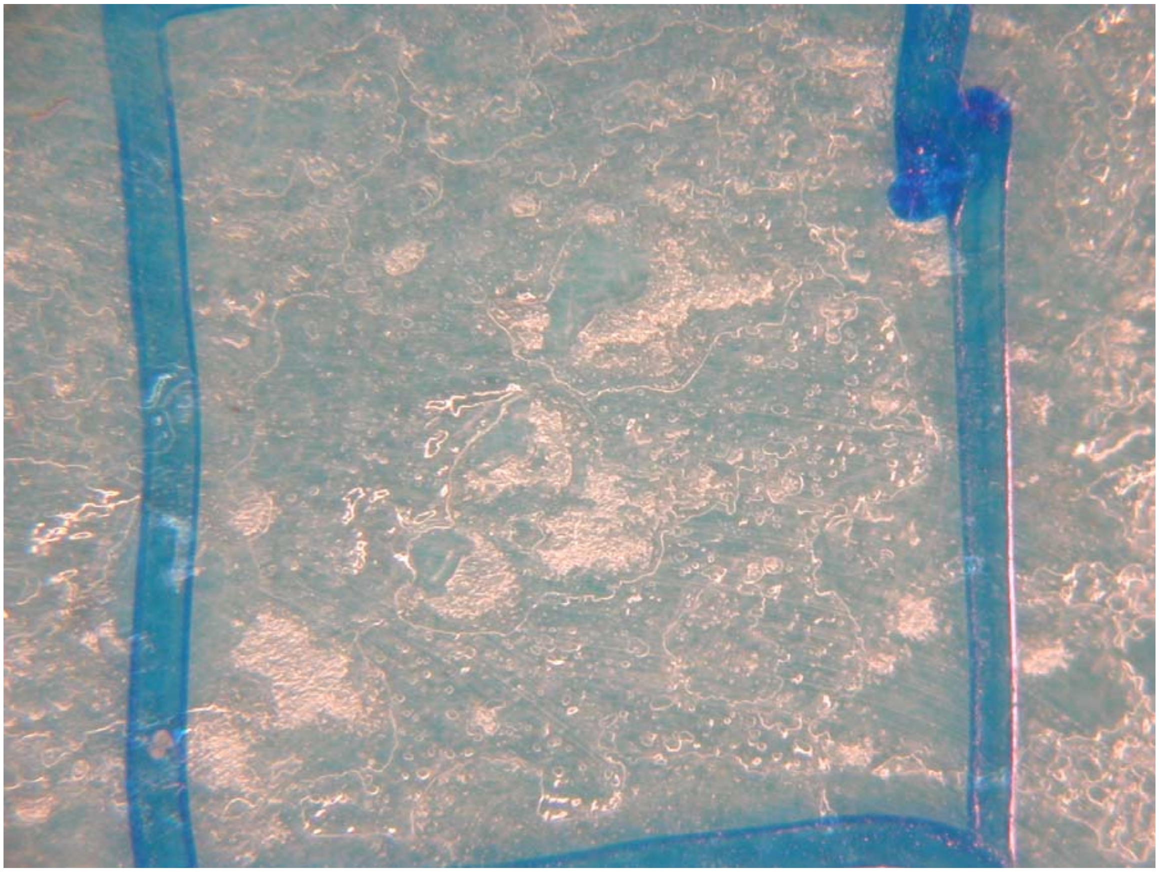
This is encouraging, though the mechanism is not well understood. To do further testing with a mechanical system that more closely approximates what we hope to be building, we used a glass slide and cover slips that are 18 mm x 18 mm and 150 microns thick. The testing setup is shown below…

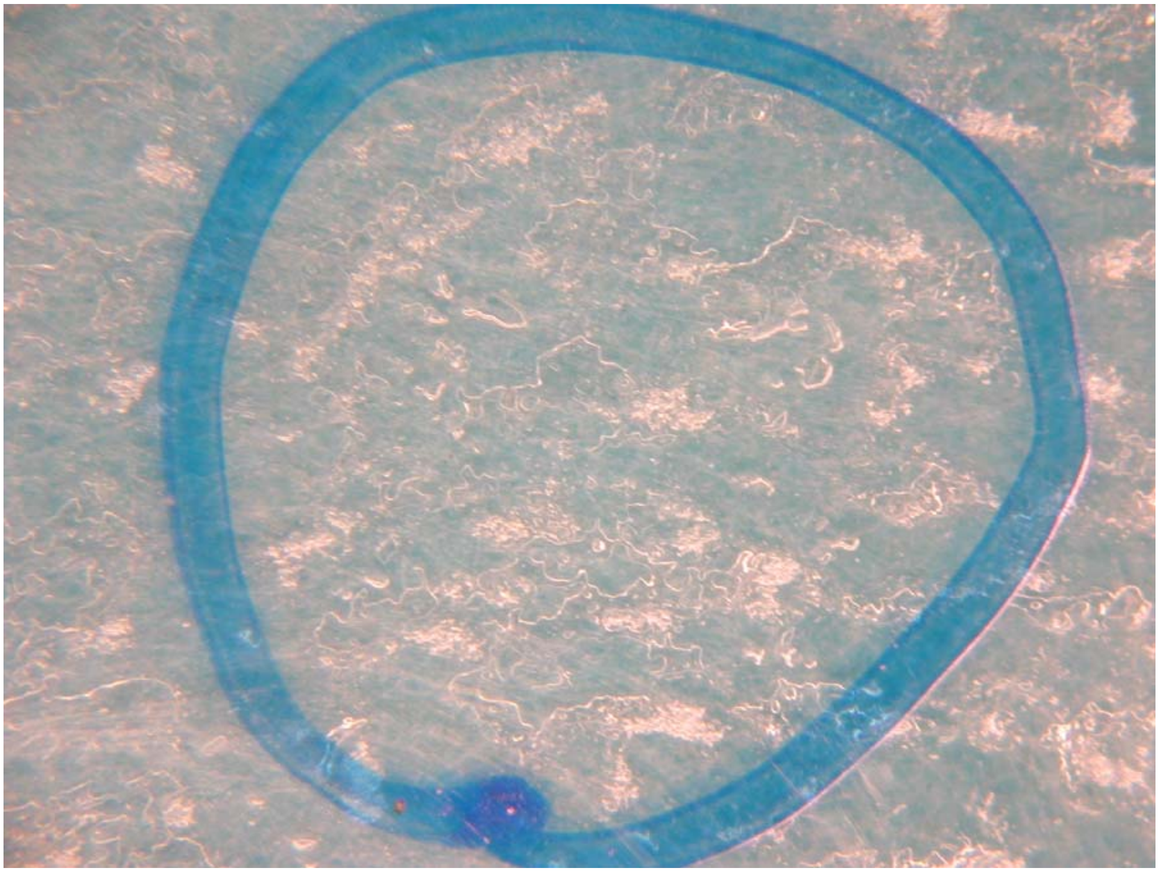


Again, we took photographs under the microscope for pre and post pressure process. The images just after laying down the cover slips are shown below (4 cover slips are pictured).


Picture 10

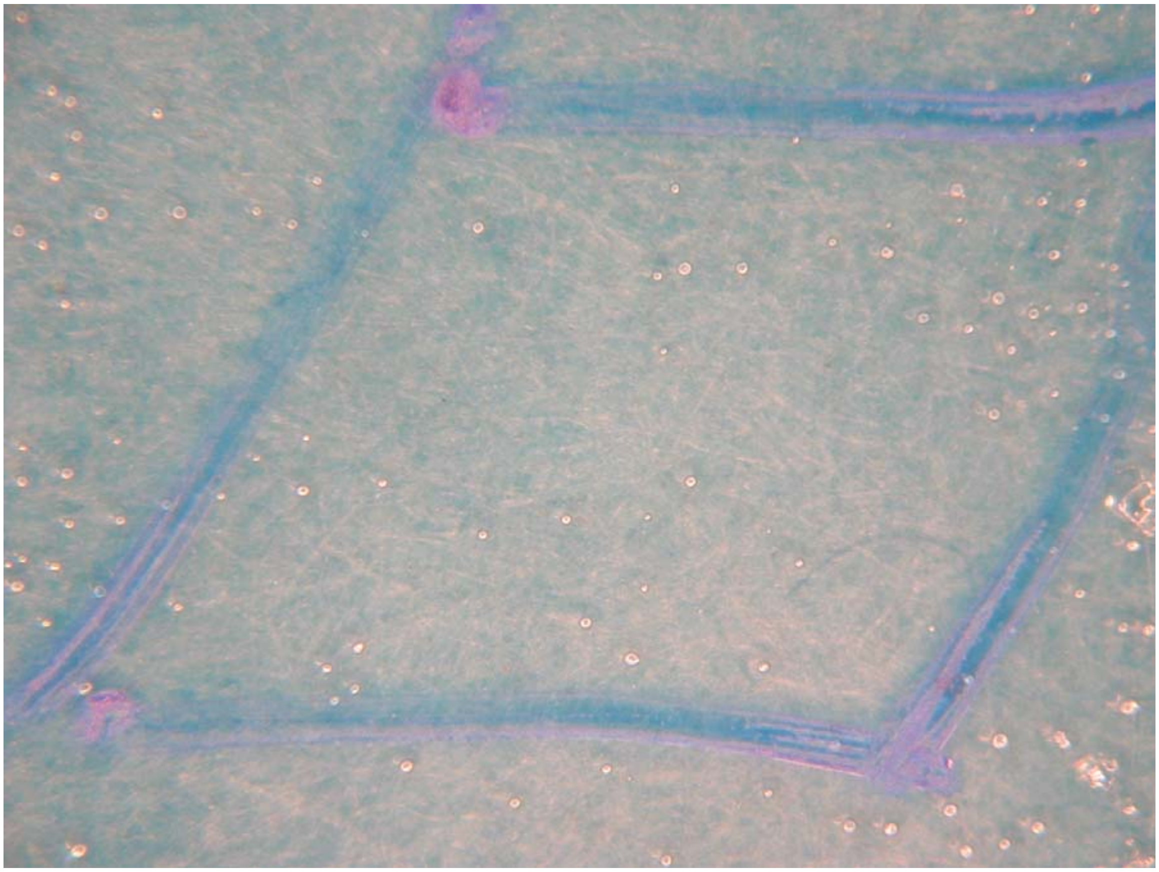

Picture 11

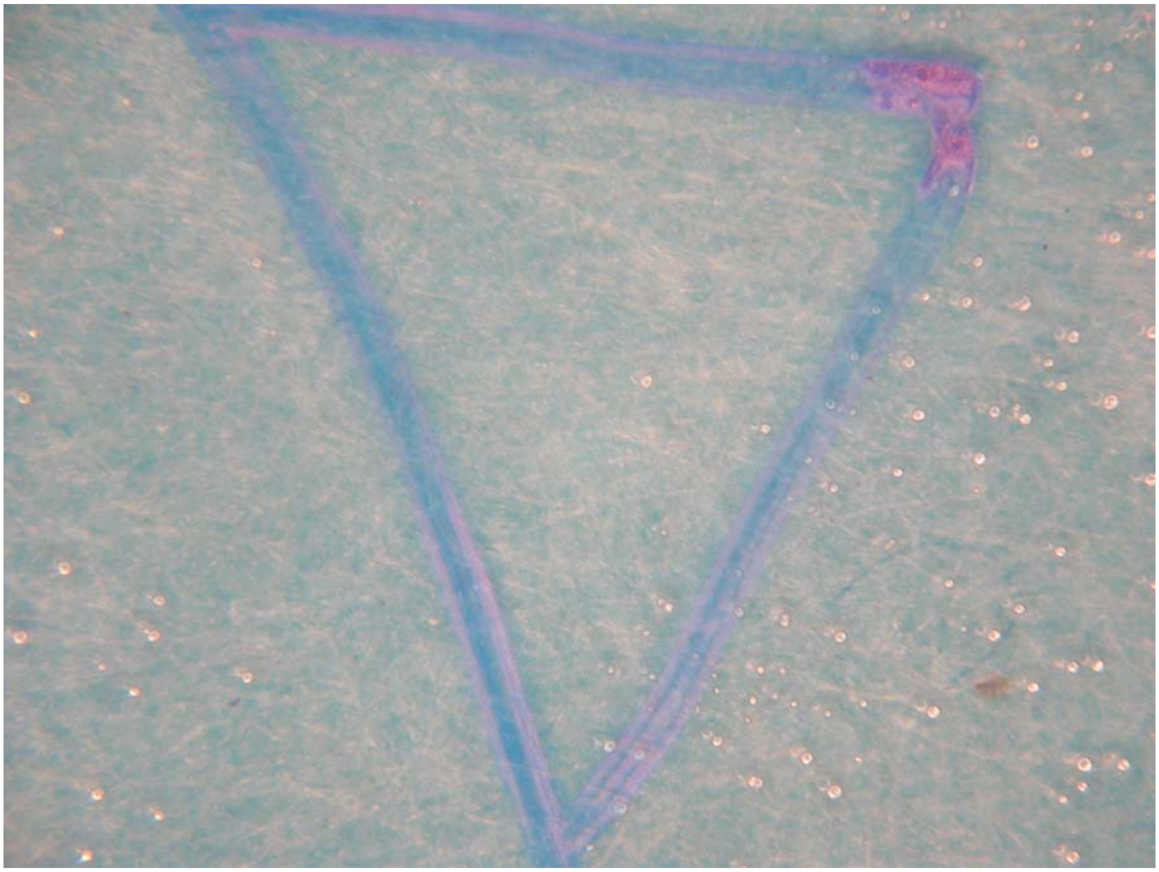

Picture 12

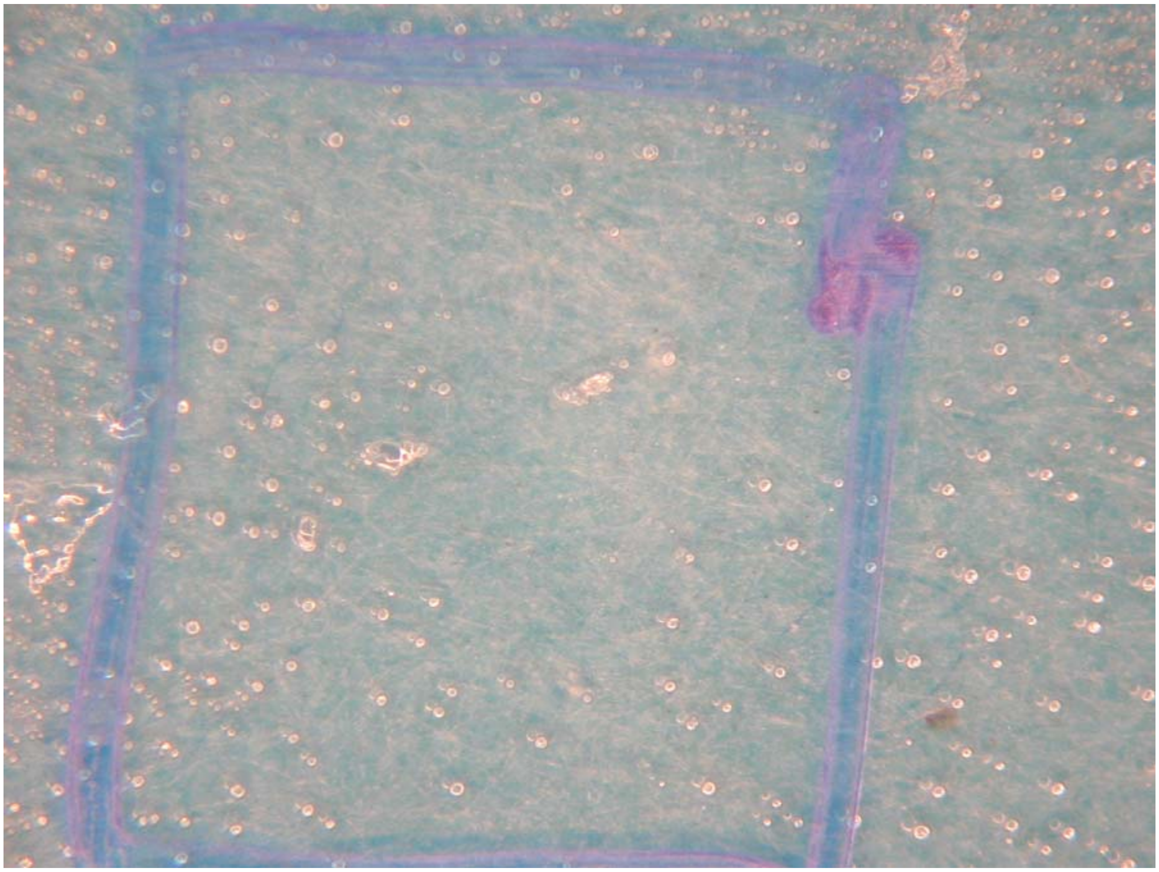


Picture 13

The slides were then pressurized to ~65 psig. For ~16 hours. The post pressurization pictures are shown below.

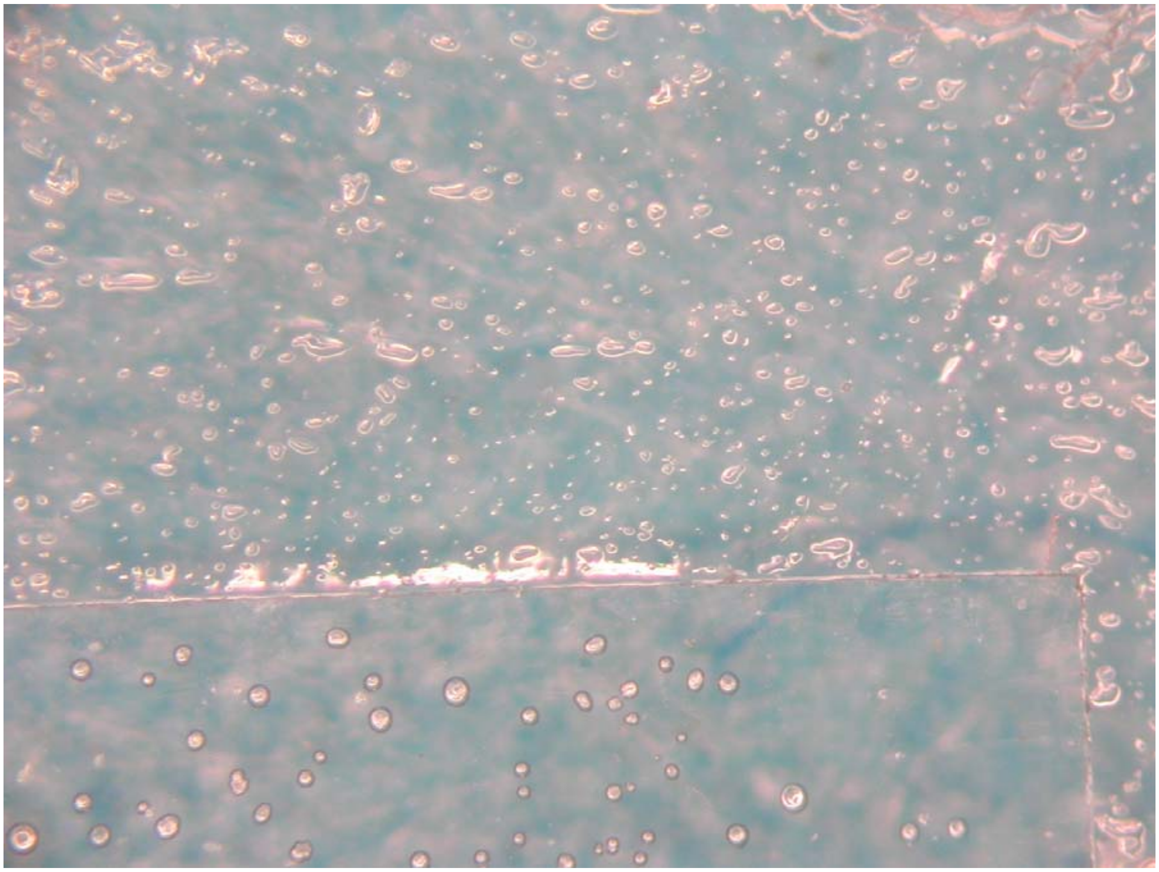

Picture 14


Picture 15


Picture 16


Picture 17

The application of pressure seems to have had the same effect on the 18mm x 18mm x 150 micron coverslip as when applied to ~1mm thick glass slides. Also of interest is that the greater adhesion and significant shrinkage/removal of air gaps appears under adhesive not covered at all as one can see in picture 18 below.


Picture 18

After this process, the overall thickness was measured the bond line thickness was calculated.
Measured Total thickness (slide + adhesive + coverslip) = 0.0487”
Measured Slide thickness = 0.0405”
Measured Coverslip thickness = 0.006”

Calculated adhesive thickness = 0.0022”