Sputtering Copper onto Glass

- Slides were set up in a holder to go into the sputtering system.
Slide #1

- First Test using Inconel/Copper
- This is after sitting overnight in Air

Problem with Cleaning which lead to problems with Inconel-Glass interface.
Notice the top right corner
Titanium/Copper
Improved chemical and plasma cleaning

Residue from scotch tape test – all films passed the tape test.
Back side showing titanium interface layer
Chromium/Copper
Chromium/Copper
Back side showing chromium interface layer
Inconel/Copper

Second test of Inconel/Copper

Improved cleaning made the difference in the film adhesion.
Copper Alone

- In the process of testing a sample was tried without any interface layer, that is copper alone.
- On this part a strip of Kapton tape was placed down the center and the part was mounted with a washer on the lower left corner.
- These is evidence of the tape adhesive along the upper edges and the lower right corner.
- In spite of the contamination this film could not be pulled off with scotch tape.
Copper Alone

- This is the back side of the slide with a single layer of Copper.
- It can be seen that the sputtering material did wrap around to the back.
- From this vantage point is can be seen that there are no imperfections in the interface between the copper and the glass.
Conclusions

- Proper cleaning and processing is critical for the adhesion of the film to the glass and to the other film.
  - In the process of plasma cleaning the parts are heated up as they do during the sputtering process, this also contributed to the film adhesion
- All the interface films were successful, even the copper film without an interface film.

FUTURE WORK

- The thickness monitor was not calibrated and all the films were approximately 10X thicker than needed. As of 12/3/09 monitor calibration was completed and set of samples are being made per the specification.
- The test samples will next be run through a temperature cycle of 400 deg C to determine if the adhesion will be affected by the expansion of the 3” long slide. The vacuum oven will be available during the week of 12/7/09 to run this test.
- At this point the sputtering system only has one gun so doing a two layer film requires venting the system to change materials, early in 2010 the second gun will be back from repair. At that point there will be no need to vent between materials.
- The system does not have the ability to apply a gold film. It is proposed to buy a compact evaporation source to install into the coating system. It appears that the cost of this is ~$7,000.
- It is evident from closer inspection of the films that there are surface imperfections. This is a subject for on-going development.