Mirror coating (SBU) and reflectivity test (BNL)

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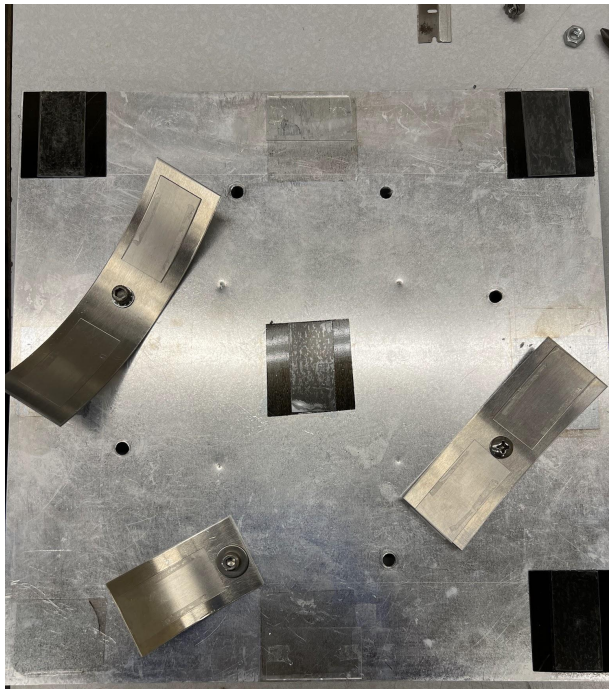
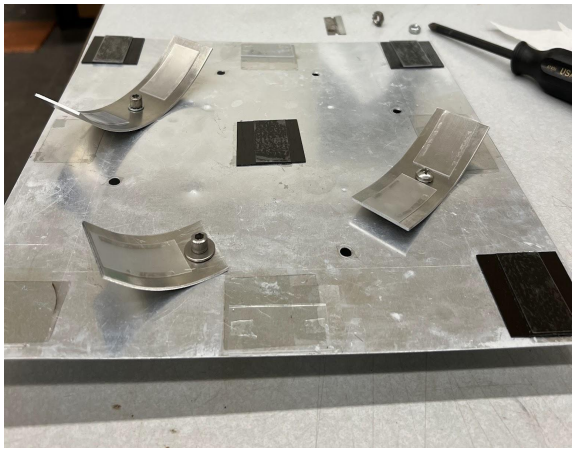
The 4th evaporation

We coated another batch on Feb 8:

1. Repeat the 3rd coating procedure with improvements on the tape. (The waviness was caused by a gap between two tape)
2. **New test on curved surfaces!**

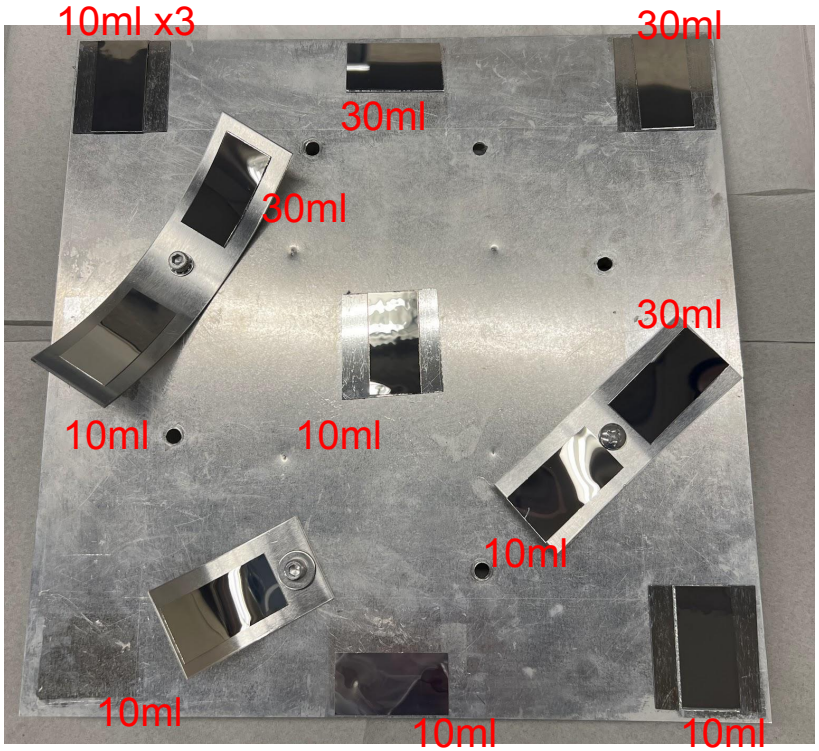




Outcome

Visually checked - good.

- 10 mil Lexan + CF is still wavy. (due to the air bubbles under the tape)
- 30 mil Lexan + CF looks better.
- Curved surface coating looks equally well. (We have three curvatures tested, all three are more curved than pfRICH)

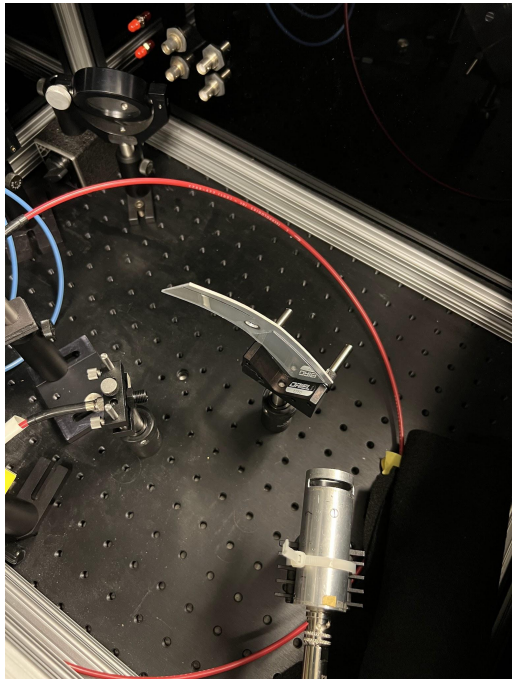


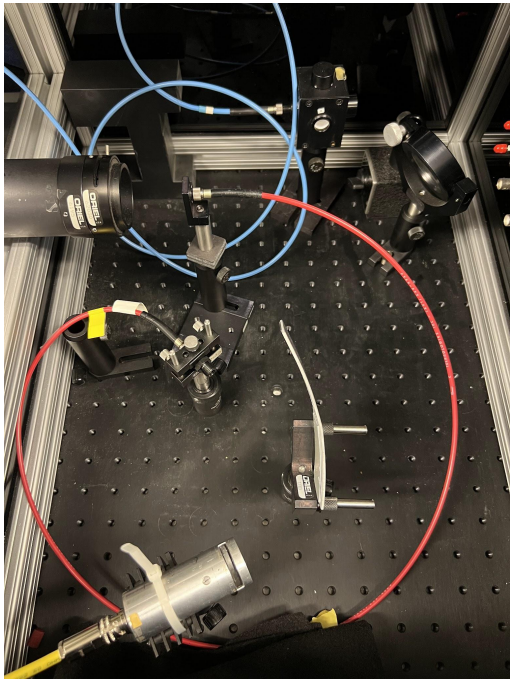
Reflectivity tests @ BNL updates

- We set it up to a **45 degree** angle
- Optimize the angle/**beam spot in the photodiode**/mirror holder position, found a **LARGE uncertainty**. (*need mechanical solutions to overcome, and we have some ideas/suggestions already*)
- Tested evaporation # 2, the batch that Bill had an **independent test** result.
- Re-tested evaporation #3, found the **reflectivities are lower** (makes more sense)
- Tested evaporation #4 with the same setup as in #3. (**consistent result**)
- Tested evaporation #4 with **curved** surface mirror. (**similar result**)

All these tests were done manually ~ 6 hours. NEED to be automated.

Reminder of the setup



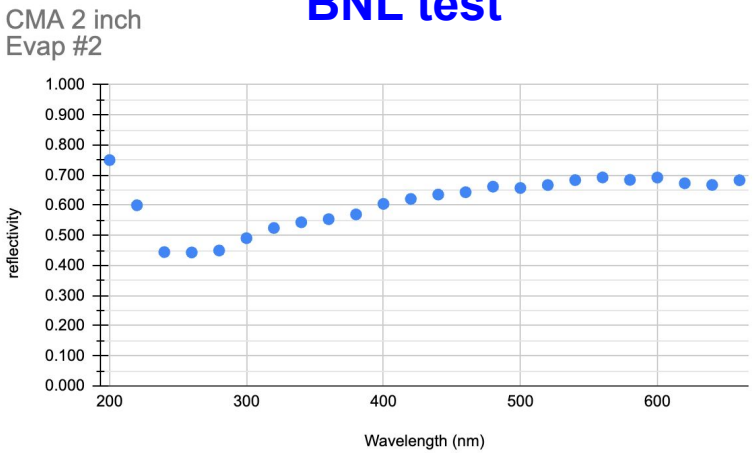


Example picture with the curved surface mounted.

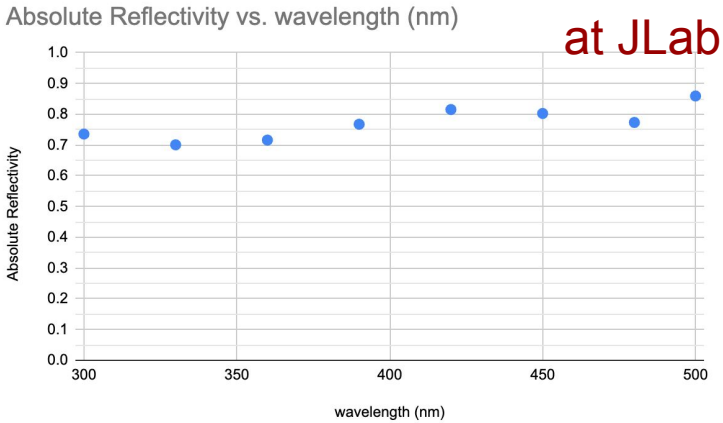
Angle set at ~ 45 degrees.

Test results 1 - comparing Jlab setup vs BNL setup

BNL test



Bill tested at JLab.

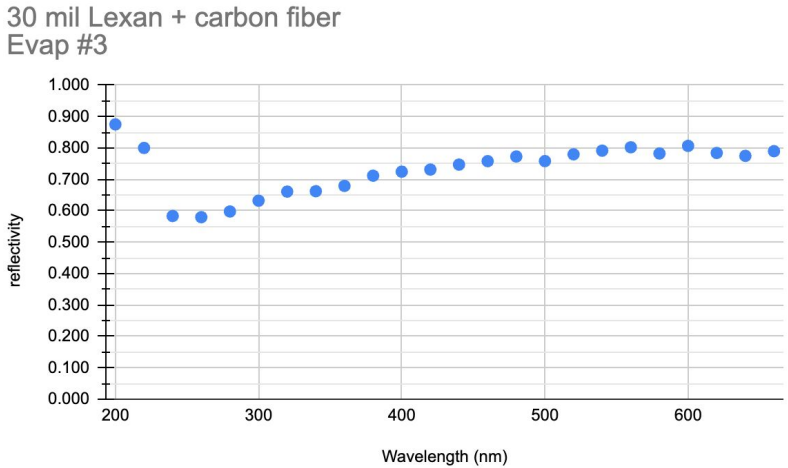


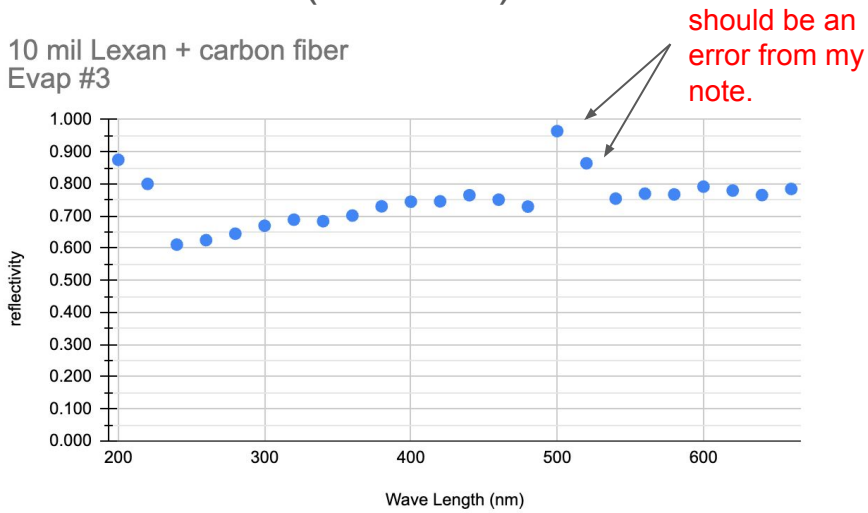
Conclusion:

Our results are more conservative and the difference gives us some guidance on the absolute reflectivity.

Test results 2 - retested Evaporation #3

Much lower than last week. Discovered the problem of the photodiode is wobbling and very different when making the direct measurement (baseline).



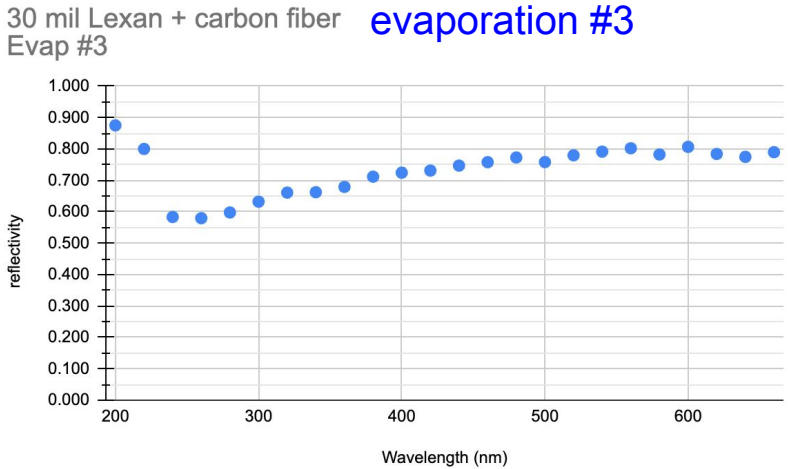


Conclusions:

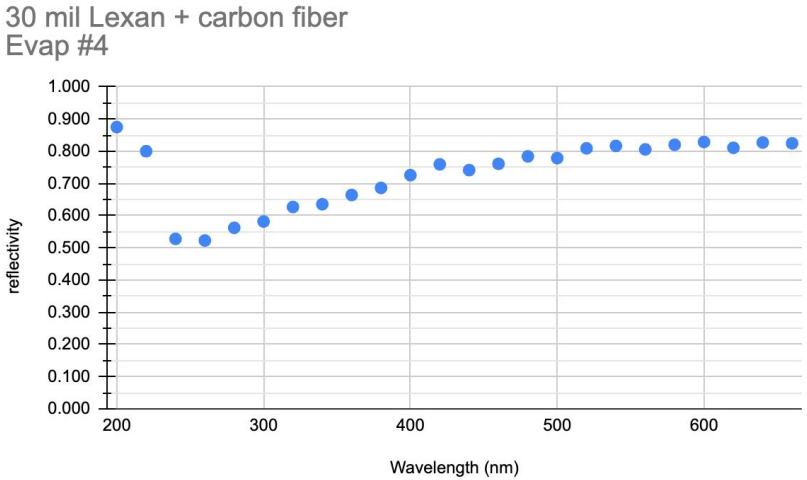
- 10 mil vs 30 mil. No difference in reflectivity. We should go for thicker one.
- At least 65-70% @ 300 nm, and 80+% @ 500 nm

Test results 3 - compare evaporation #3 vs #4

Same from last page
evaporation #3



New coating



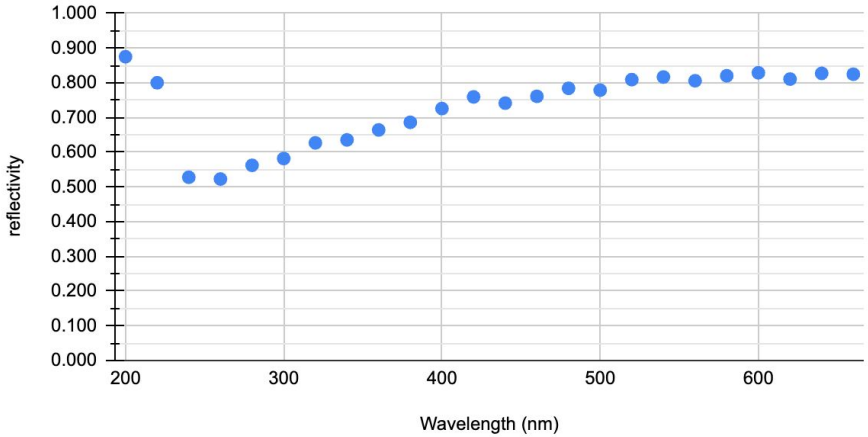
Conclusions:

- Evaporation #3 and #4 are ~ identical. We can achieve a consistent result by following a consistent procedure.

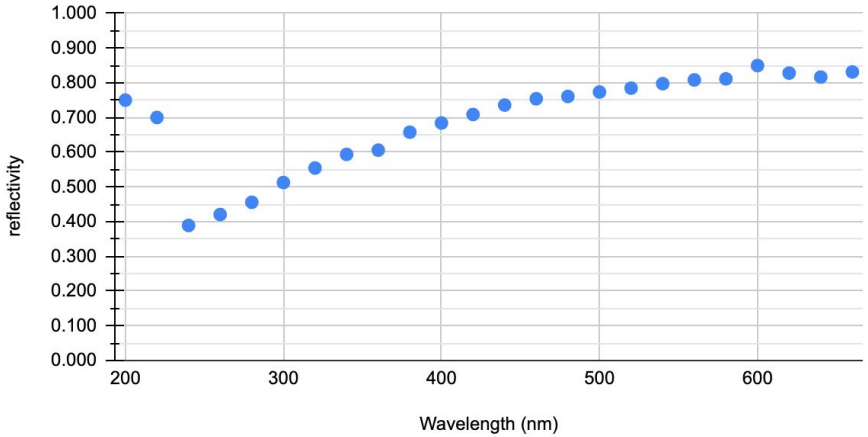
Test results 4 - flat vs curved from evaporation #4

30 mil Lexan + carbon fiber
Evap #4

Same from last page evaporation #4



30 mil Lexan on curved surface
Evap #4, least curved, top in pic



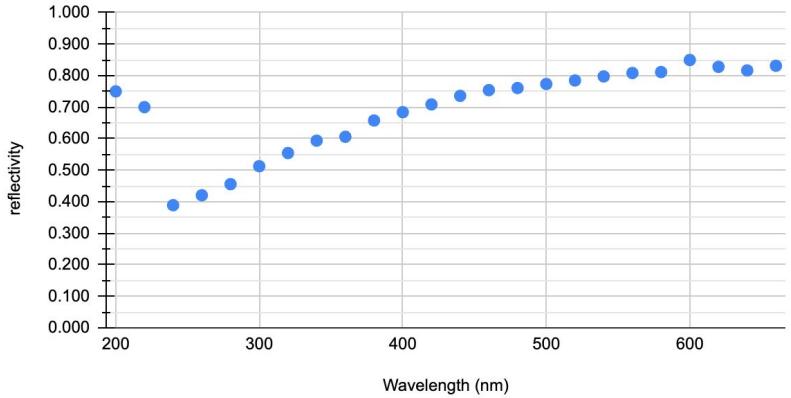
Conclusions:

- Flat and curved surface have the similar reflectivity, with slightly different wavelength dependence. This is not so much different between 300-500 nm.

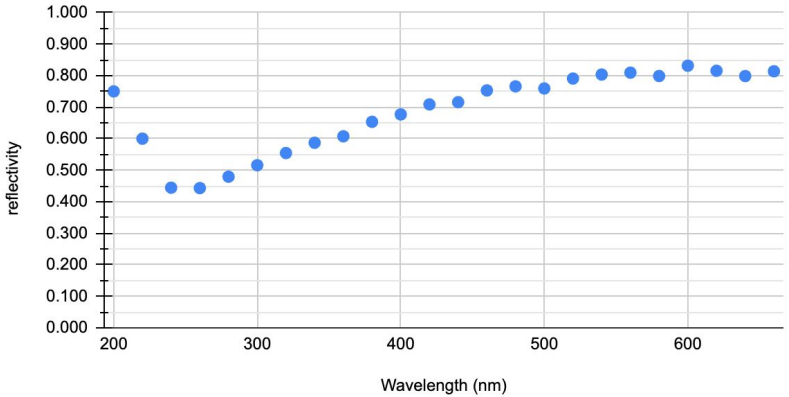
Test results 5 - 10 mil vs 30 mil on curved surface

30 mil Lexan on curved surface
Evap #4, least curved, top in pic

Same from last page
evaporation #4 on curved



10 mil Lexan on curved surface
Evap #4, least curved, top in pic



Conclusions:

- 10 mil and 30 mil Lexan (again) have the same results, even on curved surface.

Summary

What we **achieved** with a *conservative* estimate:

65-70% reflectivity @ 300 nm and 80-85% @ 500 nm on flat Lexan+CF.
50-55% reflectivity @ 300 nm and 80-85% @ 500 nm on curved Lexan.

What **we may have achieved** if we calibrate to Bill's independent result.

85-90% reflectivity @ 300 nm and 90% @ 500 nm on flat Lexan+CF.
70-75% reflectivity @ 300 nm and 90% @ 500 nm on curved Lexan.

The real performance may lie in between the two estimates.

See next page for what's next.

To-dos

Mirror coating:

- Improve **binding/gluing** method between Lexan and substrates (carbon fiber), e.g., Epoxy.
- Understand the evaporation rate with aluminium, our coating raster pattern, material deposition, for the **consistency** of future coating.
- Try different coating recipe for **improving reflectivity.**
- Large mirror sample coating.
- Even thicker Lexan? Multilayer coating, Al +Dielectric coating for UV enhancement.

Mirror testing:

- Find another way to obtain absolute reflectivity (with reference high quality mirrors, for example. Not yet ordered.)
- Understand the performance between 200-300 nm with strong wavelength dependence.
- Build a **mechanical system to minimize uncertainty** in reflectivity test.
- Build a camera system to **check the waviness** of the mirror.
- **Write software** for automated system for fast and more accurate test.

Backup

Nominal mirror reflectivity from PED plot