# Evaporator Update:

- Reflectivity Data from JLab has been graphed for all the samples
- The overleaf project documenting the mirror coating process has been updated with the reflectivity graphs, with lexan having a peak reflectivity of 82% at 480 ± 2 nm, and a low of 63% at 360 nm. 2 inch CMA having a peak of 85% at 500 ± 2 nm and a low of 70% at 330 ± 2 nm, the reflectivity values had uncertainty up to 5% when comparing the same samples over different trials on different days.
- The Dynaflux chiller motor has arrived and was installed by Kong from BNL and myself. We left the chamber to pump down over night to test its long term stability. With the chamber now running, Kong tentatively suggested having another evaporation next week to test some ideas i.e. less adhesive, dialing in the material amount, intervals for current change etc.
- A cleaning procedure was developed using the ultrasonic bath for samples prior to evaporation, but we need to identify a method to secure the set up.
- The deposition graphs were polished up but still need to be fitted to see the correlation between intensity of current and deposition over time.

# Future Evaporations + Notes

For better results in future evaporations we plan to include the following:
- less adhesive in order to prevent sample damage on removal.

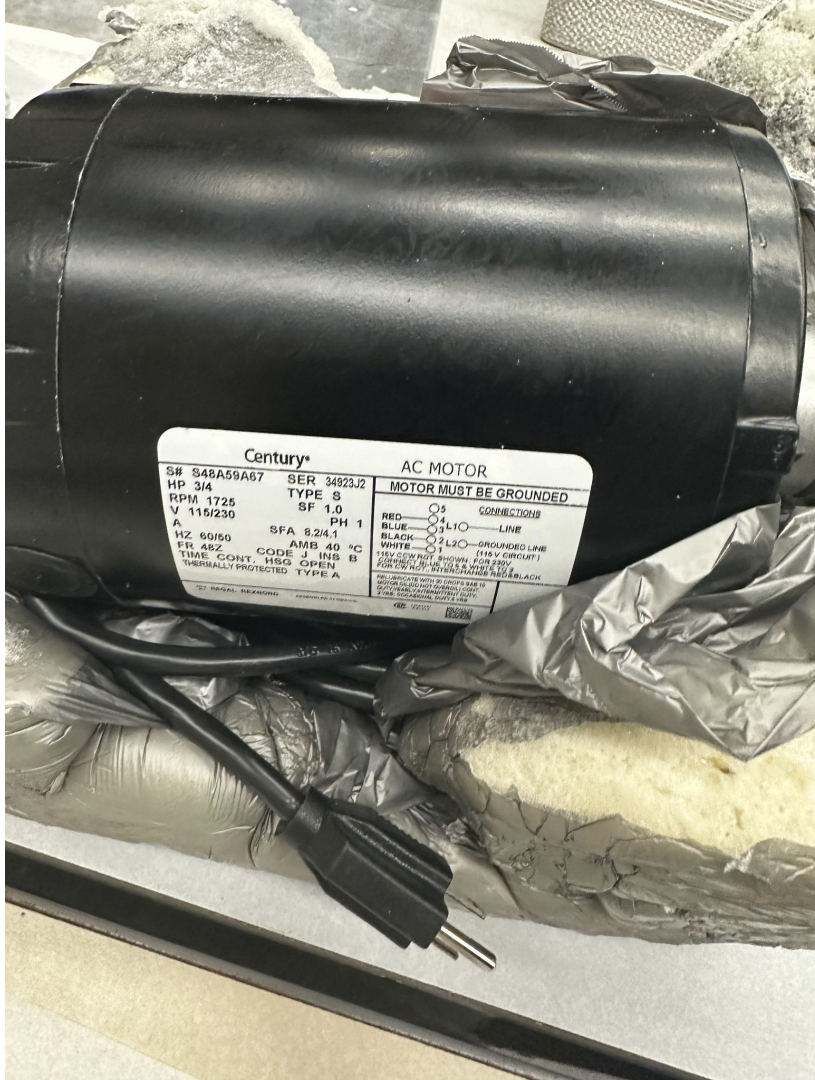
- Vary the amount of material deposited on the sample, for instance keeping the amount of mass in the crucibles as consistent as possible but changing the time or current for which we evaporate so we have less chromium or more aluminum as needed. Dialing in the amount of material needed may lead to more uniform and smooth coating.

- Checking the time between steps from prior evaporations and having a consistent step size, have more consistency between evaporations maybe a jump in current every 5 minutes or 3 minute etc…

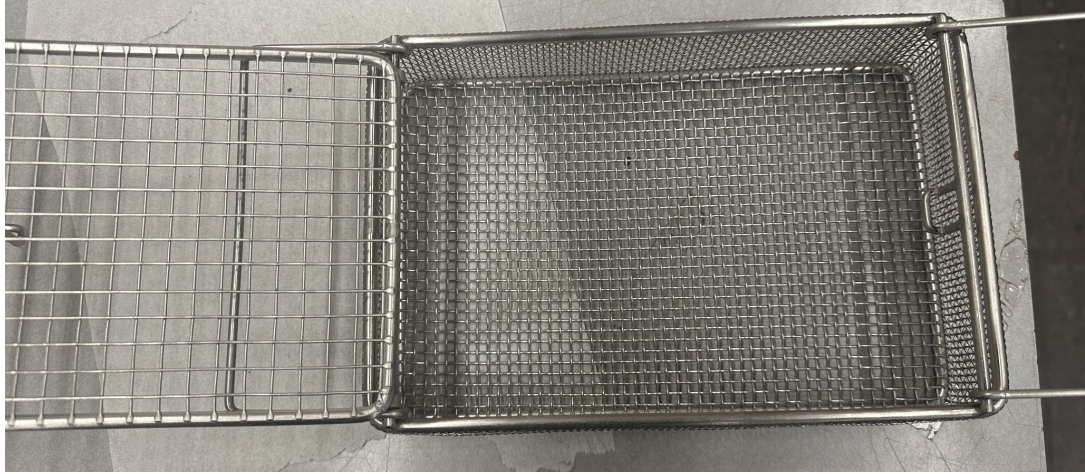
- If possible using new crucibles between tests, the crucibles that were reused from evaporation 1 to evaporation 2 had more material evaporated at the same intensity leading to inconsistencies between deposition rates despite the current and mass of material staying the same, or evaporating for a shorter time when using them
* The old crucibles have degraded and crumbled due to moisture, while we already planned to use new crucibles it is important to purchase the drybox to have storage for these crucibles.

# New Dynaflux Motor

The Dynaflux motor replacement has now arrived with the correct horsepower. The previously purchased motor was unable to push enough water as a result of being ½ HP, the new one along with the original are both ¾ HP and is operational in the short term. Kong and I fit it to the chiller and tested both the outlet and inlet flow.

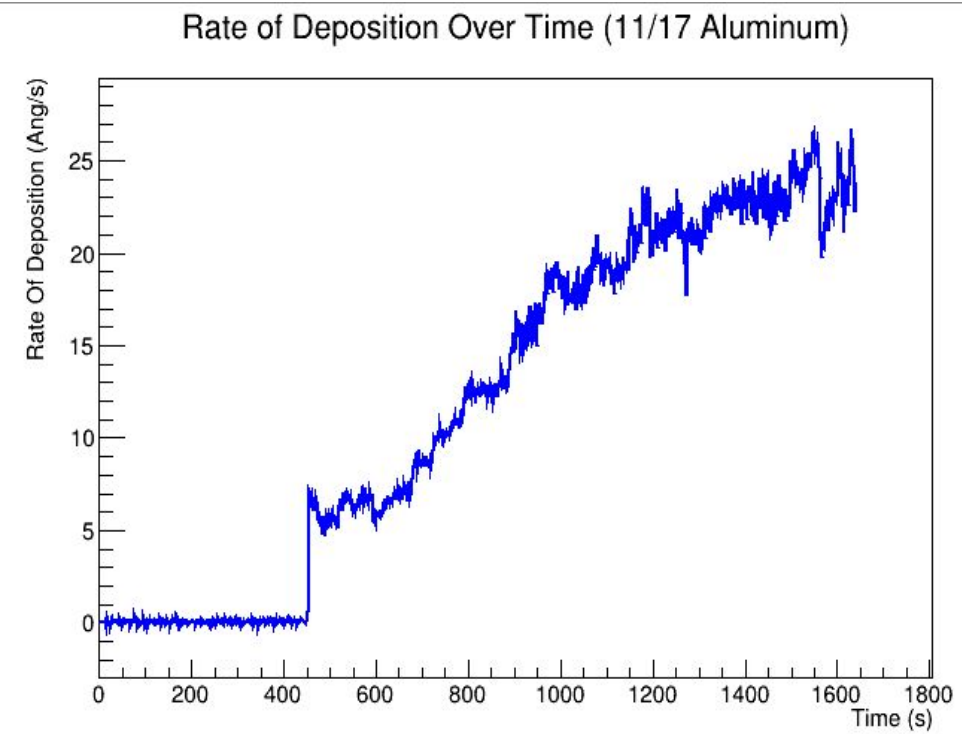


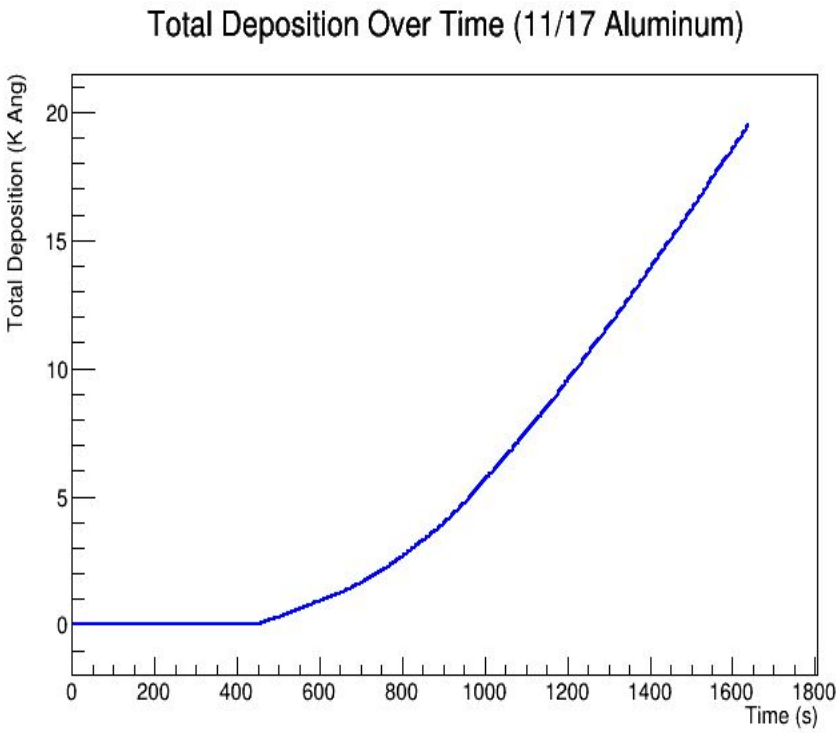
# Cleaning Procedure:

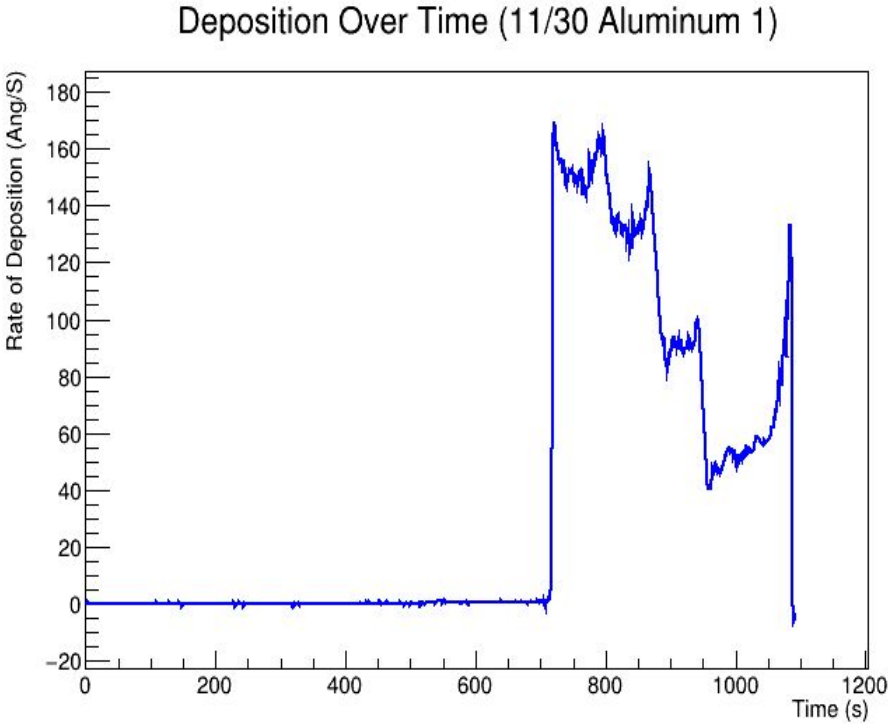


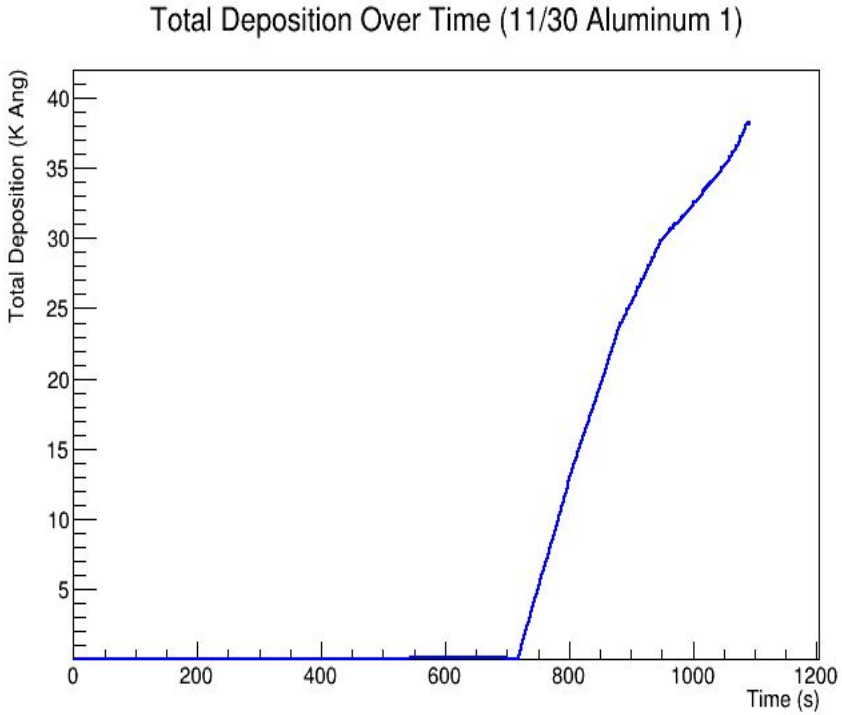
The two previous evaporation trials had no way to clean the sample before developing a coating. This provides the potential for contaminants and uneven surface roughness, we plan to introduce an ultrasonic bath to clean the substrate and place them into the above basket. Currently the bath sits too deep for us to place the basket into, some form of clamp/wire or other tool to hold the basket up would be the next step towards improving reflectivity.

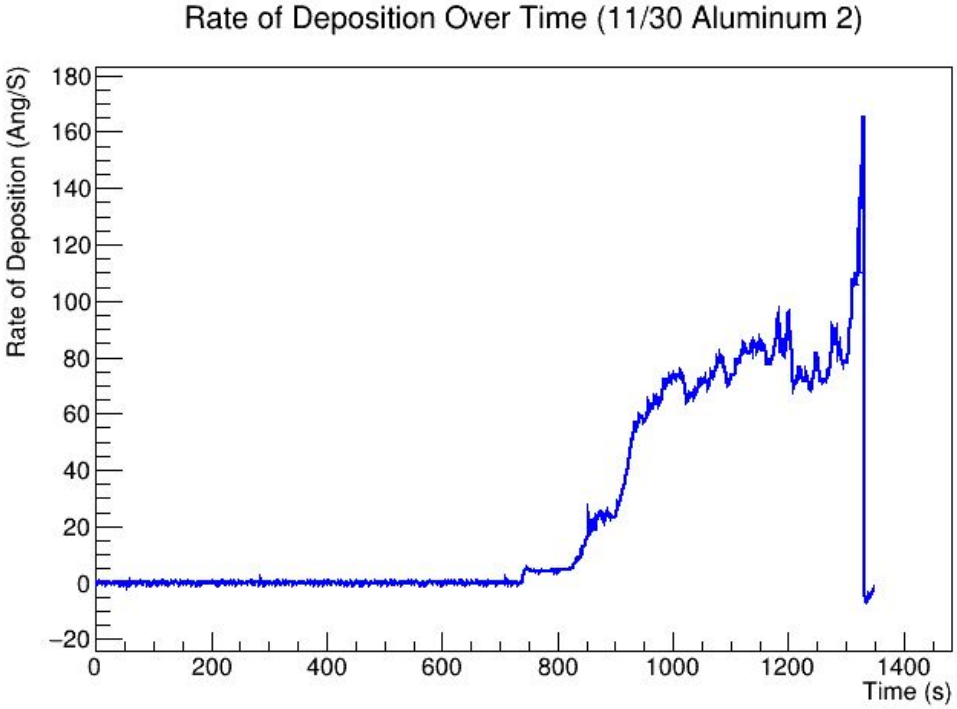
# Deposition and Reflectivity Graphs:

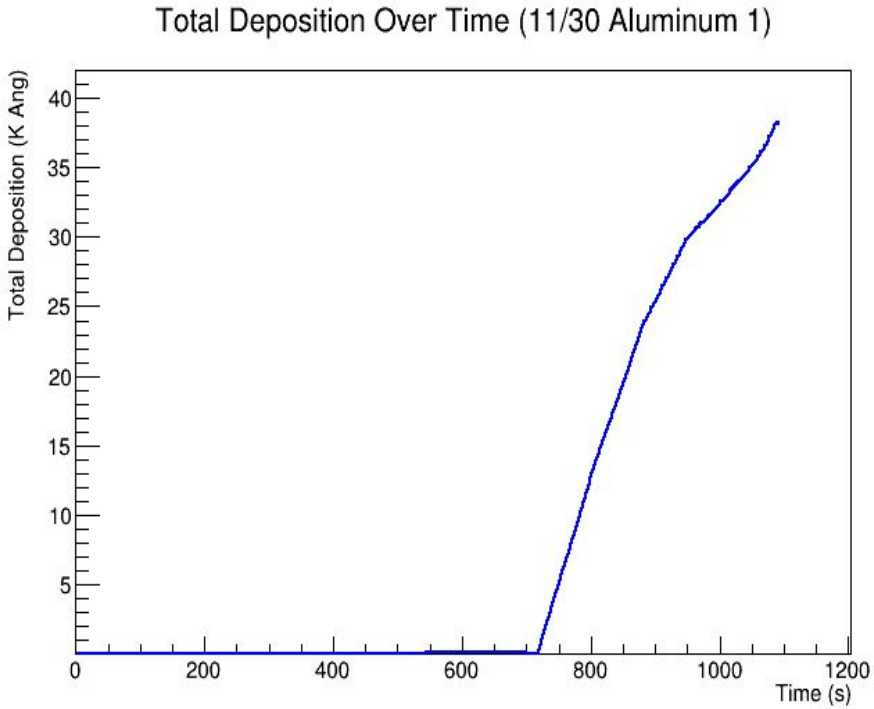


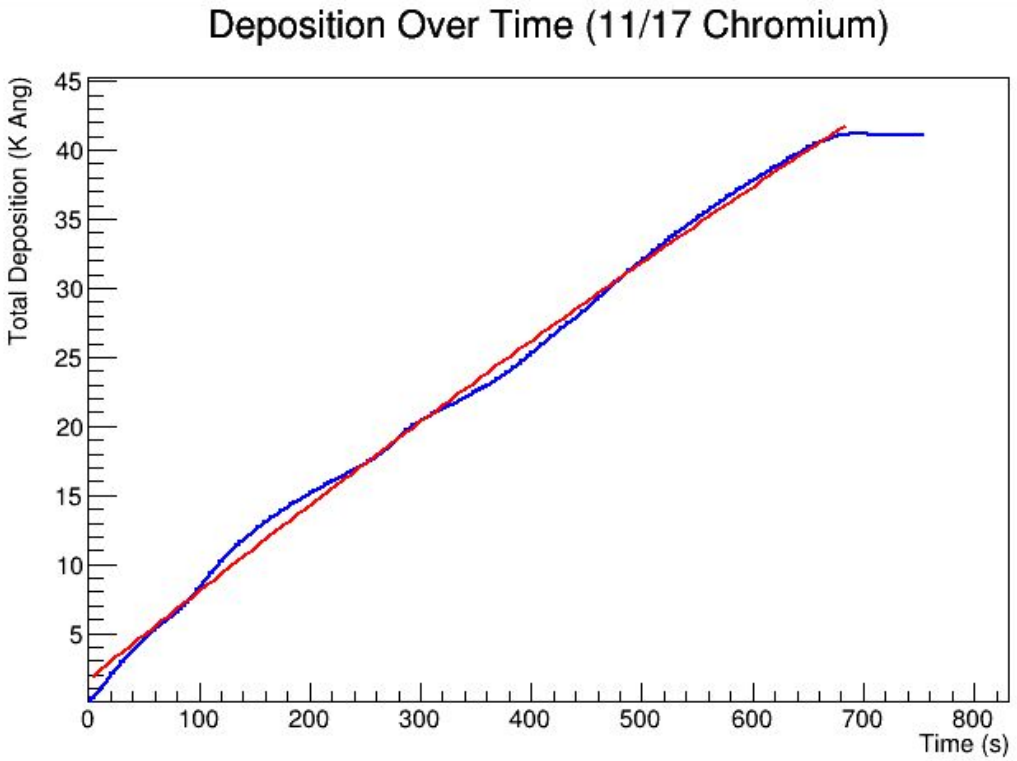




Deposition Over Time (11/30 Aluminum 1)
Rate of Deposition (Ang/S)
180
160
140
120
100
80
60
40
20
0
−20
0
200
400
600
800
1000
1200
Time (s)


Total Deposition Over Time (11/30 Aluminum 1)
Total Deposition (K Ang)
40
35
30
25
20
15
10
5
0
200
400
600
800
1000
1200
Time (s)


Rate of Deposition Over Time (11/30 Aluminum 2)
Rate of Deposition (Ang/S)
180
160
140
120
100
80
60
40
20
0
−20
0
200
400
600
800
1000
1200
1400
Time (s)


Total Deposition Over Time (11/30 Aluminum 1)
Total Deposition (K Ang)
40
35
30
25
20
15
10
5
0
200
400
600
800
1000
1200
Time (s)




The fit was bound to the point where we stopped fluctuating the current.
(before plateau)

Chi^2/NDF = 0.42

P0 = 1.67

P1 =  0.065

P2 = -9.20289e-06

12/12/2023

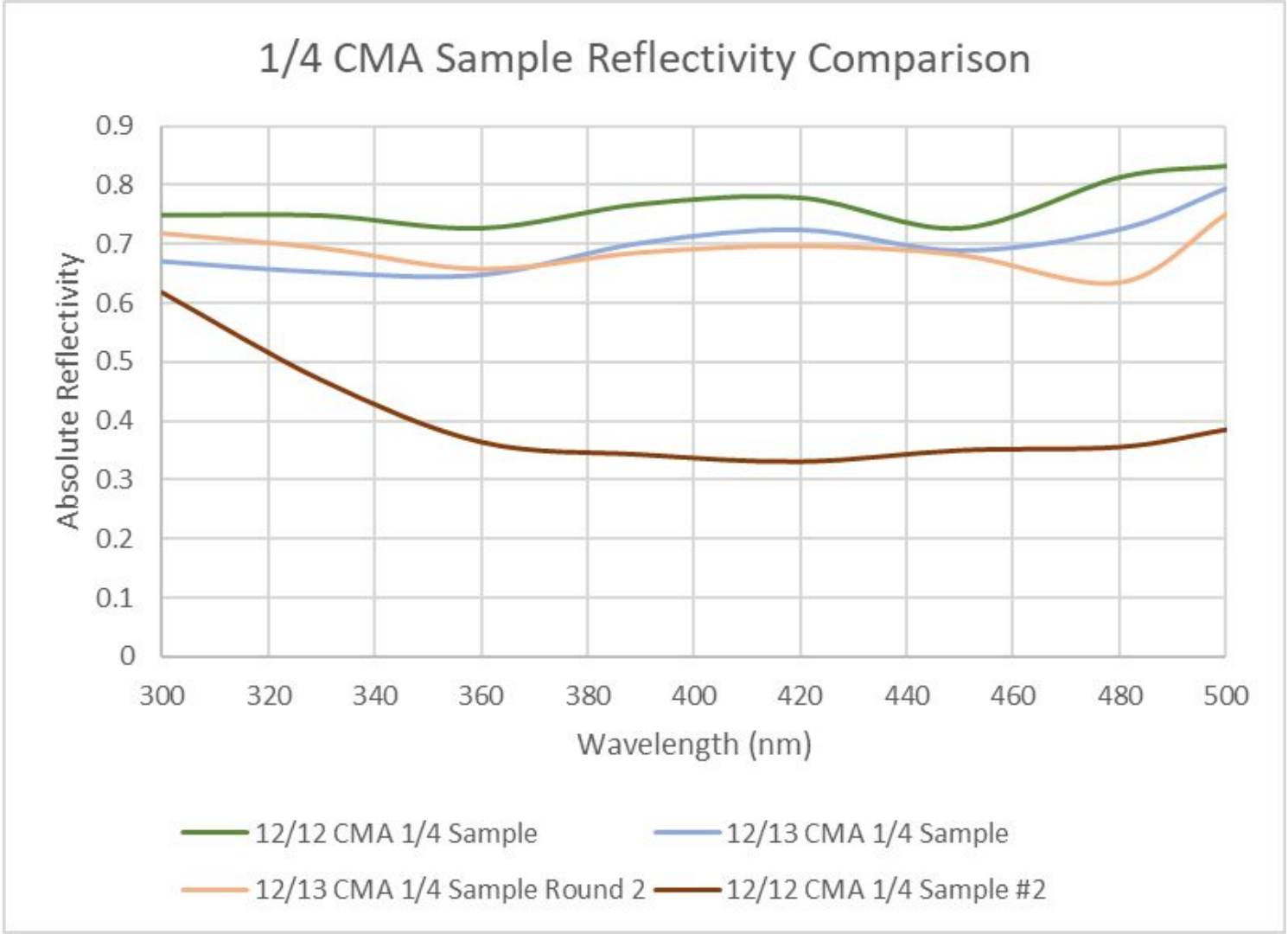
| Wavelength (nA) +- 2 nm | 1/4 Sample Round 2 | | EIC 1J | | Lexan | | Carbon Fiber | | CMA #1 Round 2 | | 1/4 Sample Round 2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Relative | Absolute | Relative | Absolute | Relative | Absolute | Relative | Absolute | Relative | Absolute | Relative | Absolute |
| 300 | 0.88 | 0.748 | 1.00 | 0.85 | 0.82 | 0.697 | 0.77 | 0.6516666667 | 0.83 | 0.7026666667 | 0.73 | 0.6176666667 |
| 330 | 0.83 | 0.7475083056 | 1.00 | 0.9 | 0.73 | 0.6548172757 | 0.58 | 0.5262458472 | 0.75 | 0.6727574751 | 0.52 | 0.4694352159 |
| 360 | 0.81 | 0.7258064516 | 1.00 | 0.9 | 0.70 | 0.6329032258 | 0.47 | 0.4250322581 | 0.75 | 0.6793548387 | 0.41 | 0.3646451613 |
| 390 | 0.85 | 0.7669014085 | 1.00 | 0.9 | 0.76 | 0.6813380282 | 0.40 | 0.3625352113 | 0.82 | 0.7352112676 | 0.38 | 0.3435211268 |
| 420 | 0.86 | 0.7776315789 | 1.00 | 0.9 | 0.79 | 0.7105263158 | 0.47 | 0.4219736842 | 0.85 | 0.7657894737 | 0.37 | 0.3315789474 |
| 450 | 0.81 | 0.7258064516 | 1.00 | 0.9 | 0.83 | 0.7475806452 | 0.48 | 0.427983871 | 0.88 | 0.7911290323 | 0.39 | 0.3508064516 |
| 480 | 0.90 | 0.8126103405 | 1.00 | 0.9 | 0.92 | 0.8239596469 | 0.52 | 0.4698612863 | 0.92 | 0.8284993695 | 0.40 | 0.3563682219 |
| 500 | 0.92 | 0.8318181818 | 1.00 | 0.9 | 0.87 | 0.7831168831 | 0.50 | 0.4538961039 | 0.92 | 0.8318181818 | 0.43 | 0.3857142857 |

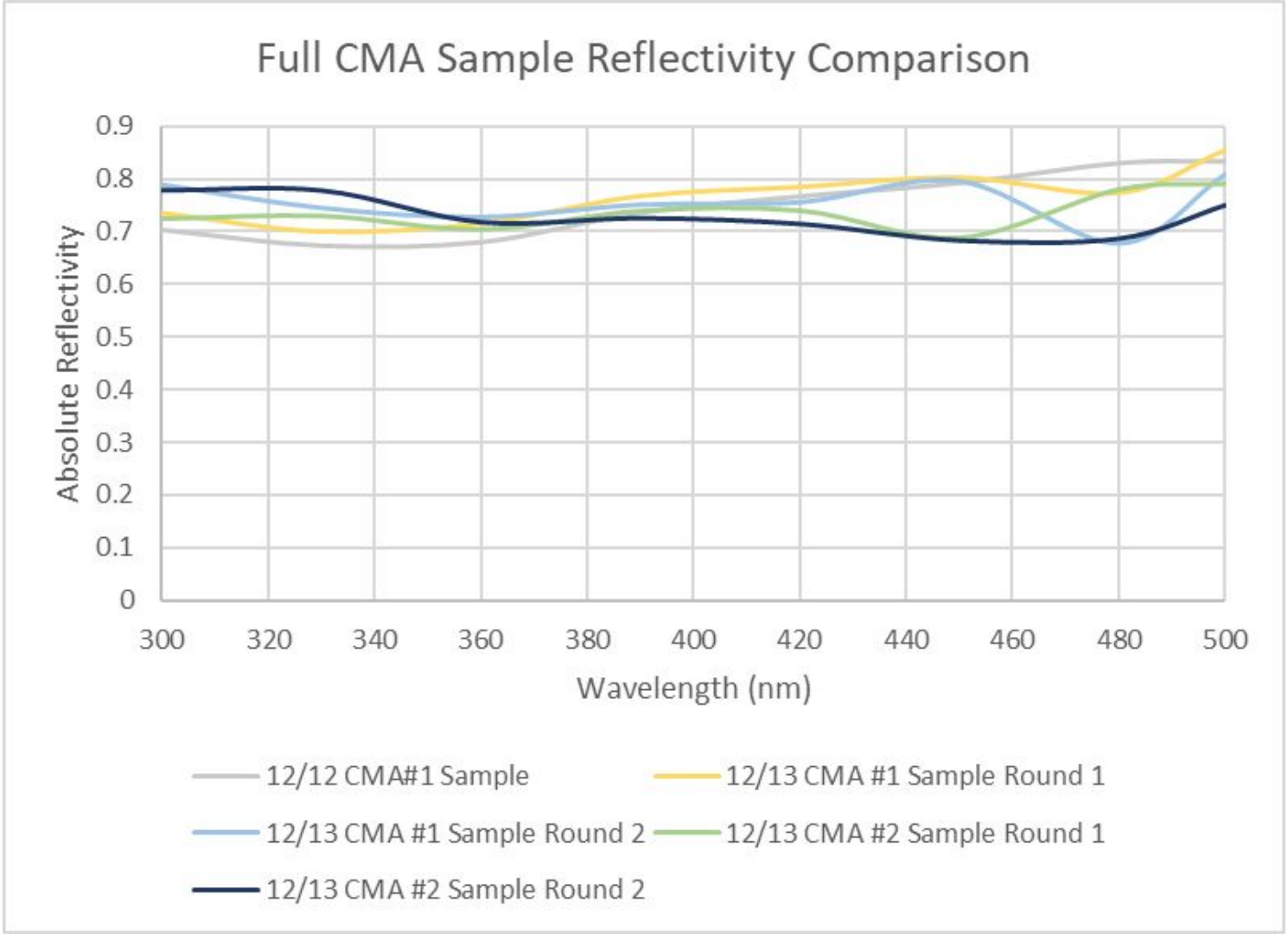
12/13/2023

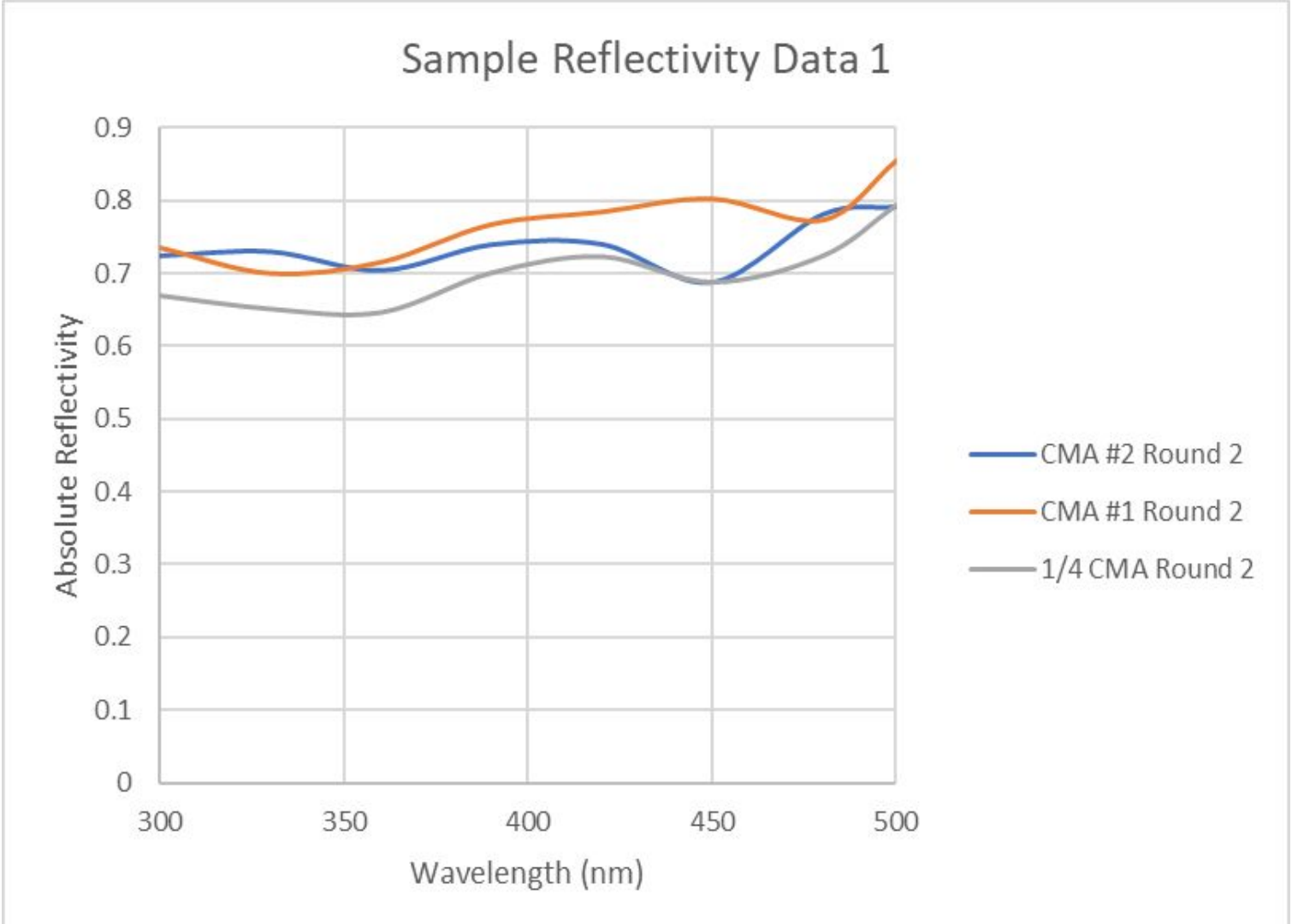
| Wavelength (nA) +- 2 nm | CMA #2 Round 2 | | EIC 6J | | CMA #1 Round 2 Repeat | | 1/4 Sample Round 2 Repeat | | EIC 1J Repeat | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Relative | Absolute | Relative | Absolute | Relative | Absolute | Relative | Absolute | Relative | Absolute |
| 300 | 0.85 | 0.7246794872 | 1.00 | 0.85 | 0.87 | 0.7355769231 | 0.79 | 0.6701923077 | 0.93 | 0.7927884615 |
| 330 | 0.81 | 0.730239521 | 1.00 | 0.9 | 0.78 | 0.7005988024 | 0.72 | 0.6520958084 | 0.94 | 0.8461077844 |
| 360 | 0.78 | 0.7046590909 | 1.00 | 0.9 | 0.80 | 0.7159090909 | 0.72 | 0.6473863636 | 0.98 | 0.8846590909 |
| 390 | 0.82 | 0.7398773006 | 1.00 | 0.9 | 0.85 | 0.7674846626 | 0.78 | 0.7012269939 | 1.02 | 0.9193251534 |
| 420 | 0.82 | 0.7403773585 | 1.00 | 0.9 | 0.87 | 0.7845283019 | 0.80 | 0.7233962264 | 1.04 | 0.9339622642 |
| 450 | 0.76 | 0.6884792627 | 1.00 | 0.9 | 0.89 | 0.8025345622 | 0.76 | 0.6884792627 | 1.01 | 0.9082949309 |
| 480 | 0.87 | 0.7808823529 | 1.00 | 0.9 | 0.86 | 0.7733193277 | 0.80 | 0.7241596639 | 1.14 | 1.024789916 |
| 500 | 0.88 | 0.7915254237 | 1.00 | 0.9 | 0.95 | 0.8542372881 | 0.88 | 0.793220339 | 1.06 | 0.9508474576 |

| Wavelength (nA) +- 2 nm | CMA #2 Round 2 | | EIC 6J | | CMA #1 Round 2 Repeat | | 1/4 Sample Round 2 Repeat | | EIC 1J Repeat | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Relative | Absolute | Relative | Absolute | Relative | Absolute | Relative | Absolute | Relative | Absolute |
| 300 | 0.91 | 0.776975945 | 1.07 | 0.9113402062 | 0.93 | 0.7886597938 | 0.85 | 0.718556701 | 1.00 | 0.85 |
| 330 | 0.86 | 0.7767515924 | 1.06 | 0.9573248408 | 0.83 | 0.7452229299 | 0.77 | 0.6936305732 | 1.00 | 0.9 |
| 360 | 0.80 | 0.7168786127 | 1.02 | 0.9156069364 | 0.81 | 0.7283236994 | 0.73 | 0.6586127168 | 1.00 | 0.9 |
| 390 | 0.80 | 0.7243243243 | 0.98 | 0.8810810811 | 0.83 | 0.7513513514 | 0.76 | 0.6864864865 | 1.00 | 0.9 |
| 420 | 0.79 | 0.7134545455 | 0.96 | 0.8672727273 | 0.84 | 0.756 | 0.77 | 0.6970909091 | 1.00 | 0.9 |
| 450 | 0.76 | 0.6821917808 | 0.99 | 0.8917808219 | 0.88 | 0.7952054795 | 0.76 | 0.6821917808 | 1.00 | 0.9 |
| 480 | 0.76 | 0.6857933579 | 0.88 | 0.7904059041 | 0.75 | 0.6791512915 | 0.71 | 0.6359778598 | 1.00 | 0.9 |
| 500 | 0.83 | 0.749197861 | 0.95 | 0.8518716578 | 0.90 | 0.8085561497 | 0.83 | 0.750802139 | 1.00 | 0.9 |

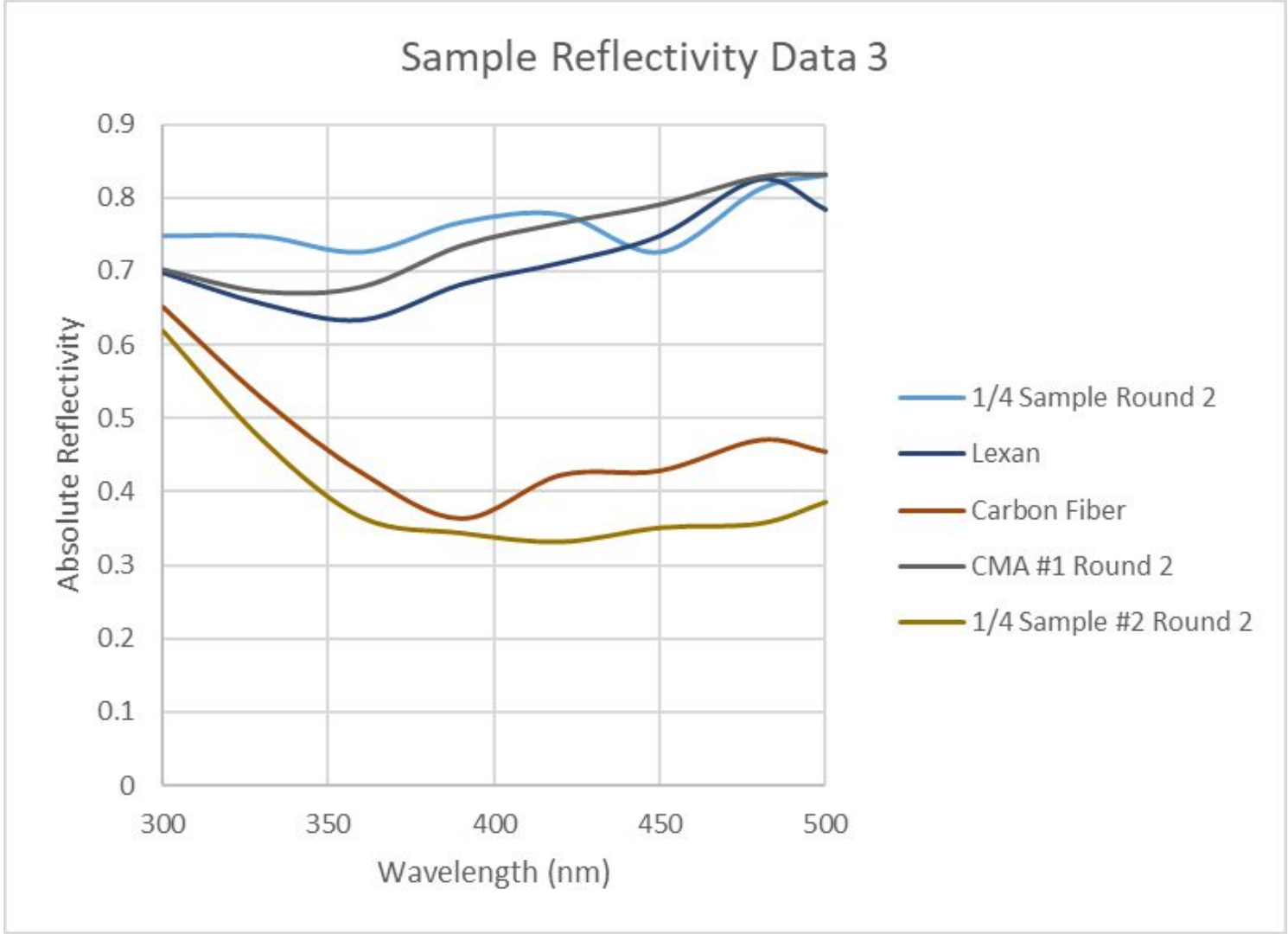
The reflectivity data from JLab was graphed per day and per trial, additional graphs were made to compare the uncertainty/discrepancy between the same piece over different trials.


1/4 CMA Sample Reflectivity Comparison
Absolute Reflectivity
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
300
320
340
360
380
400
420
440
460
480
500
Wavelength (nm)
12/12 CMA 1/4 Sample
12/13 CMA 1/4 Sample
12/13 CMA 1/4 Sample Round 2
12/12 CMA 1/4 Sample #2


Full CMA Sample Reflectivity Comparison
Absolute Reflectivity
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
300
320
340
360
380
400
420
440
460
480
500
Wavelength (nm)
12/12 CMA#1 Sample
12/13 CMA #1 Sample Round 1
12/13 CMA #1 Sample Round 2
12/13 CMA #2 Sample Round 1
12/13 CMA #2 Sample Round 2


Sample Reflectivity Data 1
Absolute Reflectivity
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
300
350
400
450
500
Wavelength (nm)
CMA #2 Round 2
CMA #1 Round 2
1/4 CMA Round 2


Sample Reflectivity Data 2
Absolute Reflectivity
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
300
350
400
450
500
Wavelength (nm)
CMA #2 Round 2
CMA #1 Round 2 Repeat
1/4 Sample Round 2 Repeat


Sample Reflectivity Data 3
Absolute Reflectivity
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
300
350
400
450
500
Wavelength (nm)
1/4 Sample Round 2
Lexan
Carbon Fiber
CMA #1 Round 2
1/4 Sample #2 Round 2