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Effect of COVID Disinfection on Flight Deck Materials

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Technical report

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16. Abstract

Due to the COVID-19 worldwide pandemic, aircraft owners and operators may find it necessary to more frequently and thoroughly disinfect airplanes. The increased use of disinfectants on aircraft materials leads to the possibility of material degradation or negative impacts on equipment. This report investigates and discusses the effects of more frequent disinfection on properties of the test articles.

The researchers identified eight materials commonly found in flight decks as well as four line replaceable units (LRUs) for this study. Four commonly used disinfection methods were identified and utilized to condition the test articles: fogging, electrostatic spraying, wiping, and UV-C disinfecting. After conditioning was complete, the test articles were evaluated for changes in their tensile strength, flammability properties, physical properties, and material properties. It was determined that all of the chemical disinfectants evaluated caused changes in at least one material property in the plastic and coating coupons tested in this study. Likewise, LRUs also experienced changes from each chemical disinfectant. Certain display coating configurations passed eight years of UV-C exposure at 254 nm and 280 nm with no change to the measured material properties while other coating configurations experienced changes at only one year of UV-C exposure.

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Acronyms

Acronym	Definition
ASTM	American Society for Testing and Materials
Assy	Assembly
COVID-19	Corona Virus Disease 2019
^{o}	Degrees
DOT	Department of Transportation
DIC	Digital Image Correlation
DMA	Dynamic Mechanical Analysis
ETL	Environmental Test Laboratory
FAA	Federal Aviation Administration
FAR	Federal Aviation Register
T_g	Glass Transition Temperature
g	Grams
in/in	Inches per Inches (measure of strain)
in/min	Inches per Minute
IPA	Isopropyl Alcohol (Isopropanol)
J	Joule(s)
J/cm^2	Joules per Centimeter Squared
KS	Kansas
LRU	Line Replaceable Unit
m	Meter(s)
mJ/cm^2	Millijoule(s) per Centimeter Squared
mW/cm^2	Milliwatt(s) per Centimeter Squared
nm	Nanometer(s)
NIAR	National Institute for Aviation Research
N/A	Not Applicable
lbf	Pound-Force
psi	Pounds per Inch
s	Seconds
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
UV-C	Ultraviolet-C
W	Watt(s)
wt	Weight

Executive summary

Due to the coronavirus disease (COVID-19) worldwide pandemic in 2019, aircraft owners and operators sometimes found it necessary to more frequently and thoroughly disinfect airplanes. The increased use of disinfectants on aircraft materials leads to the possibility of material degradation or negative impacts on equipment. The effects of more frequent disinfection were investigated and the results discussed. Previous work has been focused on the degradation of seating and other cabin materials when exposed to chemical and ultraviolet disinfection (Olivares, et al., 2021; Bhasin, et al., 2022; Ravi, et al., 2023). Current research focuses on evaluating the degradation of flight deck materials when conditioned with different forms of disinfection in a controlled environment.

In collaboration with a steering committee, the researchers identified eight materials used in the flight deck and four line replaceable units (LRUs) for this study. These material categories were plastics, display coatings, and LRUs. They contained two plastics, six display coatings, and four LRUs. Four different disinfection methods commonly used in industry were selected. Depending on material type, the test articles were evaluated for changes in flammability, tensile strength, glass transition temperature, - and optical properties.

The conditioning and testing methods followed in this study may not align with the specific recommendations or practices of each steering committee participant, but represent a generic method of evaluation.

There were four conditioning methods utilized in this study: fogging, spraying, wiping, and UV-C light exposure. Fogging and spraying methods were used to determine the effect of the aerosolized chemicals specifically on the switches and knobs of the LRUs. The wiping method simulated a real world application of chemical disinfectants on flight deck materials, which was achieved by wiping test articles by hand for a total of 1,000 cycles. The UV-C method was to simulate new methods of disinfection being implemented by the aircraft owners and operators, which was achieved by exposing test articles to different wavelengths of UV-C light for various exposure times.

The plastic and coating test articles were conditioned using the wiping and UV-C methods. The LRUs were conditioned using the fogging, spraying, and wiping methods. Since the LRUs were donated they could not be sent to a third party vendor for UV-C disinfection.

The test articles conditioned with UV-C disinfectant were initially conditioned at an accelerated equivalent exposure time representing a four year duration at one cycle per day, which was considered the first round of conditioning. Based on the test results after the first round of UV-C disinfection, the equivalent but not yet conditioned test articles were selected to be conditioned for either one or eight years of simulated duration for round two of UV-C disinfection.

The fogging and spraying methods were applied to the four LRUs to determine if the aerosolized chemical disinfectants caused a change in the weight, visual appearance, or functional capabilities of the LRU. After conditioning checks were completes on the mechanical function of the switches, buttons, and knobs, as well as the LRU units being subjected to a flight simulator.

1 Introduction

1.1 Overview

The goal of this report is to study the effects of the disinfectants used on materials found in aircraft flight decks as a response to the COVID-19 pandemic. Material selection was conducted in collaboration with the Steering Committee. The Steering Committee was comprised of various aircraft original equipment manufacturers (OEMs), owners, operators, and the Federal Aviation Administration (FAA). The test articles evaluated include LRUs, plastics, and display coatings which went through a number of examinations as presented in Figure 1 through Figure 3. The LRUs were conditioned with the selected chemical disinfectants through fogging, spraying, and wiping methods, and were evaluated for any changes visually and to the mechanical functionality, as well as quantitative changes in weight and powered functionality. The plastic coupon test articles were either conditioned with chemical disinfectants using the wiping method, or they were exposed to UV-C radiation as another disinfection method. After conditioning, plastic coupons were evaluated qualitatively for visual changes, and evaluated quantitatively for any change in mechanical properties, flame resistance, glass transition temperature, and weight. The display-coating test articles were conditioned with the same disinfectants and methods as the plastic coupons and were evaluated qualitatively for visual changes, and quantitatively for changes in oleophobicity, haziness, and weight. The results for all test articles were analyzed and compared to unconditioned control specimens to determine the magnitude of the change in properties or performance.

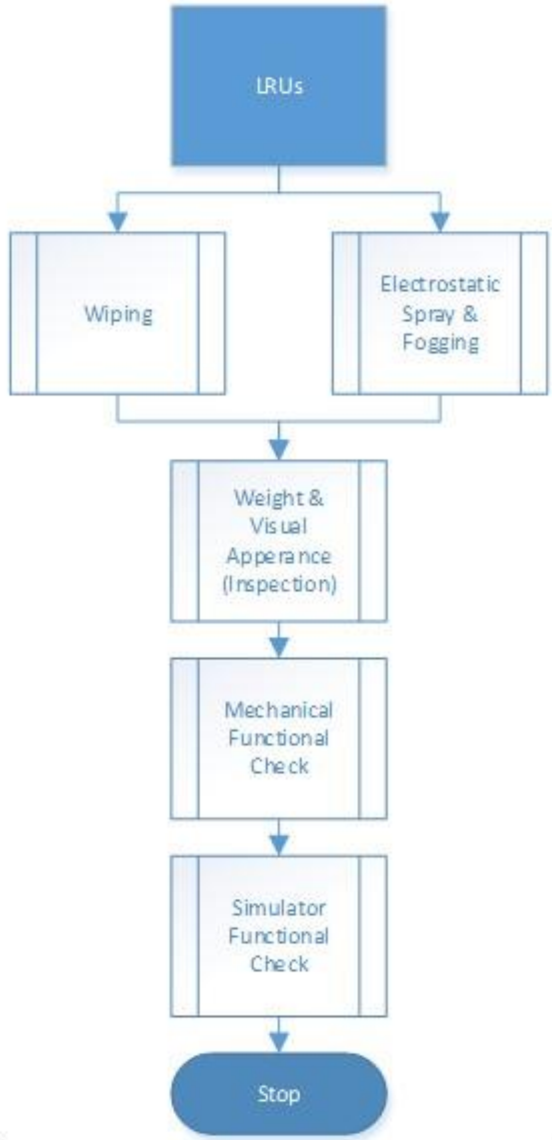

Figure 1. Flowchart outlining project overview for the LRUs

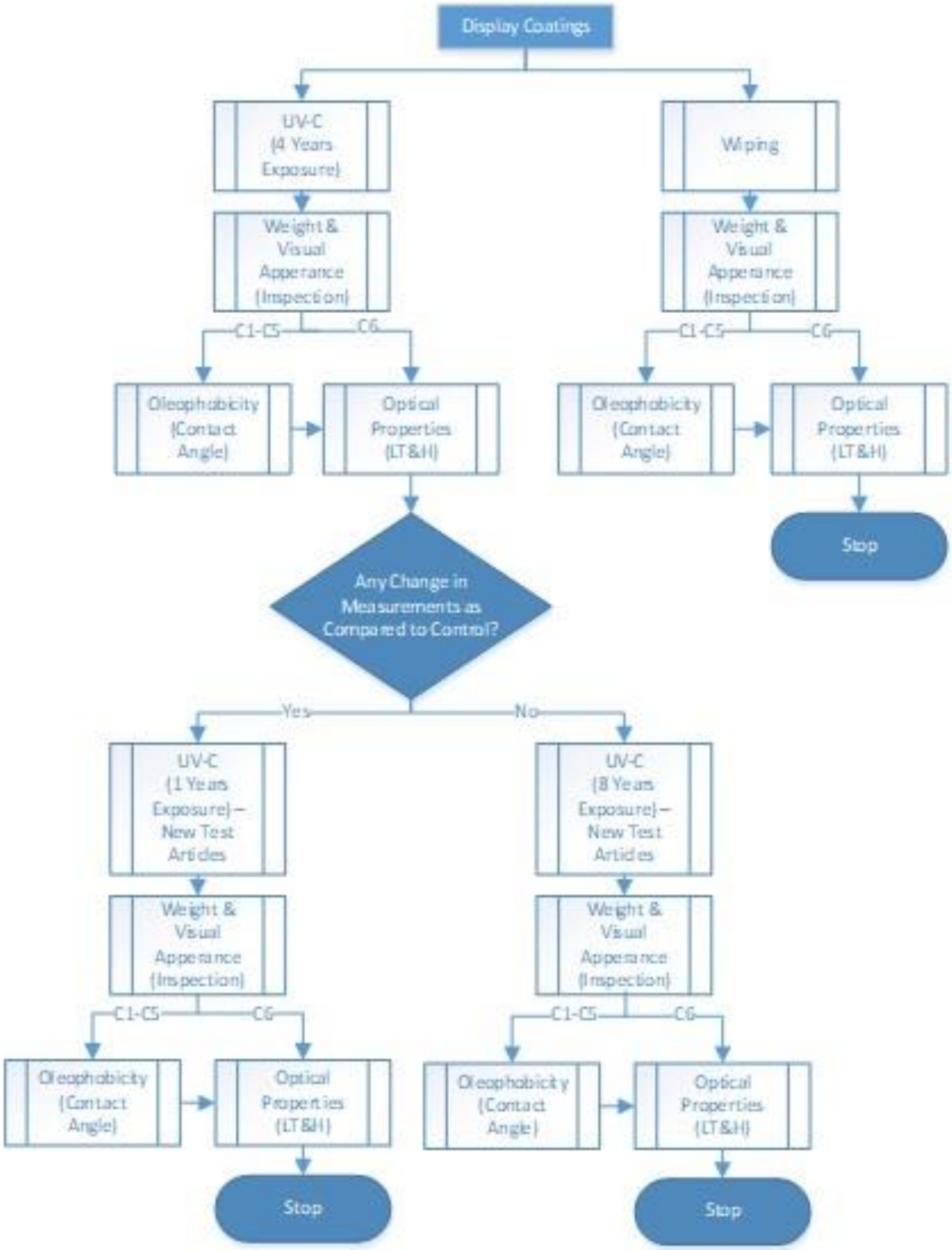

Figure 2. Flowchart outlining project overview for the display coatings

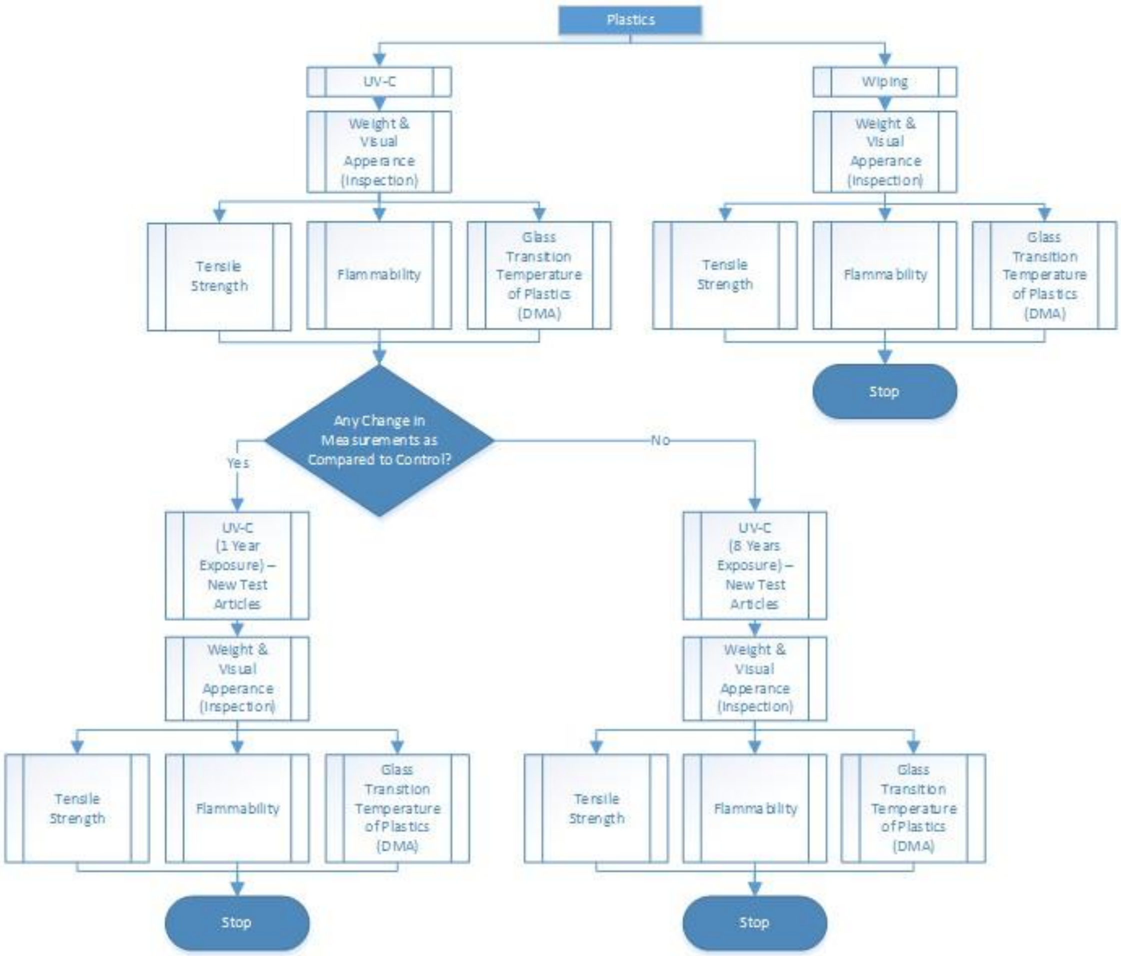

Figure 3. Flowchart outlining project overview for the plastics

1.2 Selection of disinfectants for study

The chemical disinfectants evaluated in this research project were selected based on known efficacy against the COVID-19 virus and were selected in collaboration with the Steering Committee from EPA List N (United States Environmental Protection Agency, 2021) and based on their likelihood of use in aircraft flight decks, as determined through an FAA operator survey (van Bergeijk, Khajehpour, & Gonzalez, 2023). This operator survey was conducted to determine which disinfectants were actually in use on in-service aircraft, along with their application methods and application frequency. The operator survey can be found in Appendix G of *Effects of Disinfectants on Aircraft Flight Deck Materials* by van Bergeijk, Khajehpour, & Gonzalez. For the purpose of this project, the disinfectants were not evaluated for their efficacy against the virus, but were only evaluated for causing degradation of the materials tested in this study. The disinfectants selected for study are as follows:

- Control: No treatment
- 70% Isopropyl Alcohol (IPA)
- Calla® 1452
- Sani-Cide EX3
- Bactrokill +
- PREempt™ RTU
- Pheno D
- UV-C (three wavelengths at various exposure durations)

1.3 Disinfectant conditioning of test articles

The selected conditioning methods were chosen to show the wide range of possible disinfection methods implemented on aircraft to allow the risks of material degradation to be more fully understood. The application methods of the disinfectants included wiping, spraying, fogging, and exposure to UV-C light. Based on a previous study conducted on seating materials, it was determined that the specimens which were wiped would be conditioned for 1000 disinfectant application cycles (Olivares, et al., 2021). This was based on two assumptions. Firstly, that the interior of the aircraft would be disinfected once per flight which would average out to 3000 disinfection cycles per year. The second assumption was that the effects and possible damage caused by the disinfectants would reach an equilibrium at four months of application, or 1000 cycles. The LRU test articles were subjected to 120 cycles of fogging/electrostatic spraying to simulate a rate of one application of the disinfectant per day for four months. The test articles were given an adequate amount of time to air dry between each cycle to simulate real-world disinfection procedures. This test procedure included the worst-case scenario for application of the chemical disinfectants, as none of the disinfectants were diluted, nor where they wiped off the surface between cycles.

1.4 Material testing

The specific effects of disinfection on flight deck materials that were determined to be of interest were changes in the:

- weight,
- visual appearance (qualitative photo comparison),
- tensile strength (ASTM D638),
- flammability (CFR §25.853 Appendix F),
- optical properties (light transmission and haze),
- oleophobicity (contact angle),
- glass transition temperature of plastics (dynamic mechanical analysis).

The evaluations of these criteria are all important since their effect could have a near term impact on the continuation of airworthiness of the flight deck.

2 Test article information

For this project, three different categories of materials found in an aircraft flight deck were selected with the aid of the Steering Committee. These material were two plastics, six display coatings, and four LRUs. The coatings were representative first surface display coatings, each applied on glass substrates. All disinfection took place on the coated surface of the glass substrate.

The following materials found in the flight deck were selected for study:

- Plastics
    - Lexan™ 9600
    - Poly II acrylic

- Coatings
  - Antireflective/antiglare/Oleophobic Coating A
  - Oleophobic Coating B
  - Oleophobic Coating C
  - Oleophobic Coating D
  - Antireflective/antiglare/conductive/Oleophobic Coating A
  - Antireflective/conductive coating
- Four LRUs
  - Air Conditioning Panel
  - Forward Panel Assembly (Assy)
  - Stall Warning Assembly
  - Instrument Switching

The following disinfectants were selected for the study:

- Pheno D
- 70% Isopropyl Alcohol (IPA)
- Calla® 1452
- Sani-Cide EX3
- Bactrokill +
- PREempt™ RTU
- Ultraviolet-C (UV-C) light exposure at 222 nm, 254 nm, and 280 nm.

The plastic and coating test articles were conditioned using the wiping and UV-C methods. The LRUs were conditioned using the fogging, spraying, and wiping methods. The LRUs were not conditioned using the UV-C method due to the units being donated and therefore could not be sent to a third party vendor for UV-C treatment. The LRUs were conditioned with the fogging and spraying methods to determine the effect of the aerosolized chemicals on the switches and knobs of the units.

Each material category was evaluated for different changes in properties based on their location and use in the aircraft. All materials were evaluated for visual changes and changes in weight. Plastics were evaluated for changes in tensile strength, flammability, and glass-transition temperature values. Coatings were evaluated for changes in optical properties and oleophobicity. The LRUs were evaluated for changes in the mechanical and powered functionality of the knobs, switches, dials, and buttons as well as any other tactile changes.

3 Disinfection information

For this study, six chemical disinfectants typically used for disinfecting the flight deck of aircrafts were selected with the collaboration of the Steering Committee. Table 1 lists the chemical disinfectants evaluated and their compositions.

Table 2 shows the UV-C dosage and duration for each wavelength used.

Table 1. Details of the chemical disinfectants

Disinfectant	**Composition**		
	Active Ingredients	**Active Ingredients (wt %)**	**Inert Ingredients (wt %)**
Sani-Cide EX3 (Celeste Industries Corportation, 2017)	L-Lactic Acid	0.4	99.6
PREempt™ RTU (Virox Technologies Inc., 2015)	Hydrogen Peroxide	0.5	99.5
Pheno D (Big D Industies Inc., 2018)	Ethanol	50-55	50-45
70% IPA (LabChem Inc., 2009)	Isopropyl Alcohol	70	30
Calla® 1452 (Zip-Chem Products, 2010)	Alkyl Dimethyl benzyl-ammonium chloride	1.09	96.96
	Di(octyl-decyl) Dimethyl Ammonium Chloride	1.63	
	Ethanol	0.32	
	Chloride Dioxide	0.2	

Disinfectant	Composition		
	Active Ingredients	Active Ingredients (wt %)	Inert Ingredients (wt %)
Bactrokill + (Bactronix Corp.)	n-Alkyl Dimethyl Benzyl Ammonium Chloride	0.085	99.5
	n-Alkyl Ethylbenzyl Ammonium Chloride	0.085	

Table 2. UV-C dosage for each wavelength and duration

Simulated Years of Exposure/ Duration	Wavelengths (nm)	Dosage (mJ/cm^2)	Cumulative Dosage (1 treatment/ day)
1	280	40	14600
4	280	40	58400
8	280	40	116500
1	254	40	14600
4	254	40	58400
8	254	40	116500
1	222	3	1095
4	222	3	4380
8	222	3	8760

**Note*: All UV-C test articles were initially conditioned to simulate four years of exposure. Based on subsequent material evaluation performance, additional unused equivalent test articles were exposed for either one or eight years.

4 Specimen conditioning

Test articles were conditioned using one of four different methods; fogging, spraying, wiping, and UV-C radiation. The details of each method are explained in the following sections.

4.1 Fogging and electrostatic spraying method

The LRU test articles were conditioned by fogging the test articles for approximately two seconds from a distance of 12 inches away from the test article. The overall volume of liquid disinfectant applied was not recorded for fogging or electrostatic spraying. Masks were applied to the test article so that only the designated areas of the test article would be conditioned, and to avoid cross contamination between disinfectant products. The test article was mounted horizontally in a test fixture which held the units in a manner to prevent the disinfectant from dripping down onto other areas of the units. Fogging was achieved with commercially available pressurized aerosol containers of the disinfectant solution, which was applied with the supplied nozzle. A designated dry time between each cycle of fogging was defined as waiting until the test article was visually dry or until ten minutes had passed, whichever came first. The test article was subjected to 120 cycles of conditioning. After conditioning, the test articles were weighed, photographed, and the mechanical functionality check was completed as described in section 8.2. Figure 4 through Figure 7 show the setup for the fogging conditioning method. This setup remained the same for the spraying method which used a RYOBI™ ONE+ electrostatic sprayer. This device electrically charged the disinfectant particles as they were applied to the test article from a distance of approximately 12 inches, with a sweep rate of two seconds. The masking used for the fogging did not perform as well when used for the spraying method, thus an updated mask was used as seen in Figure 8 and Figure 9.

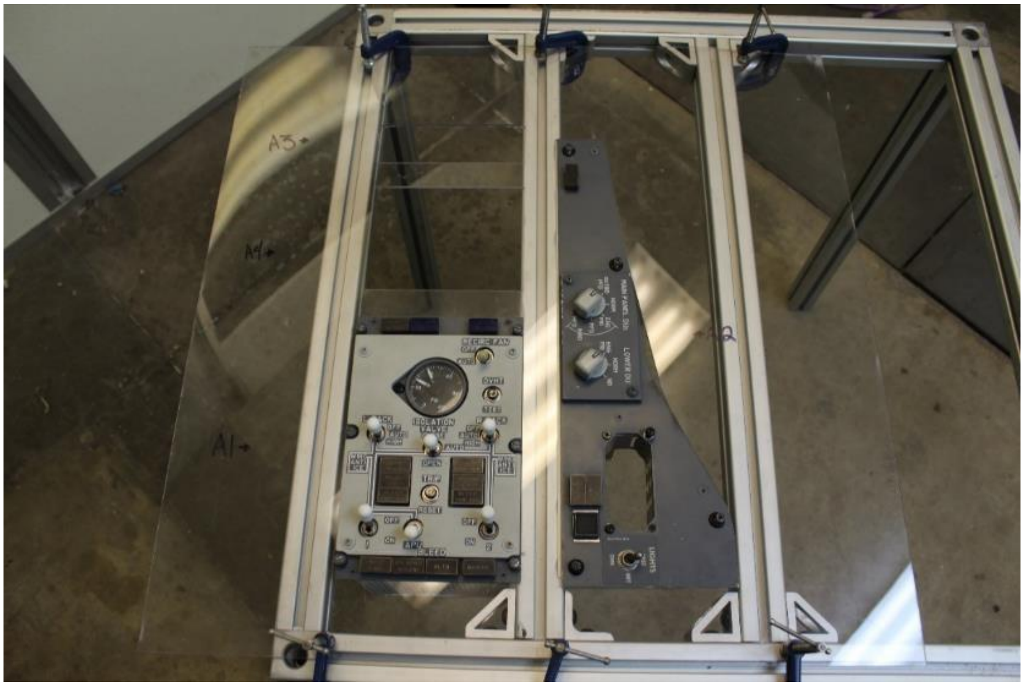

Figure 4. Fogging setup – top view

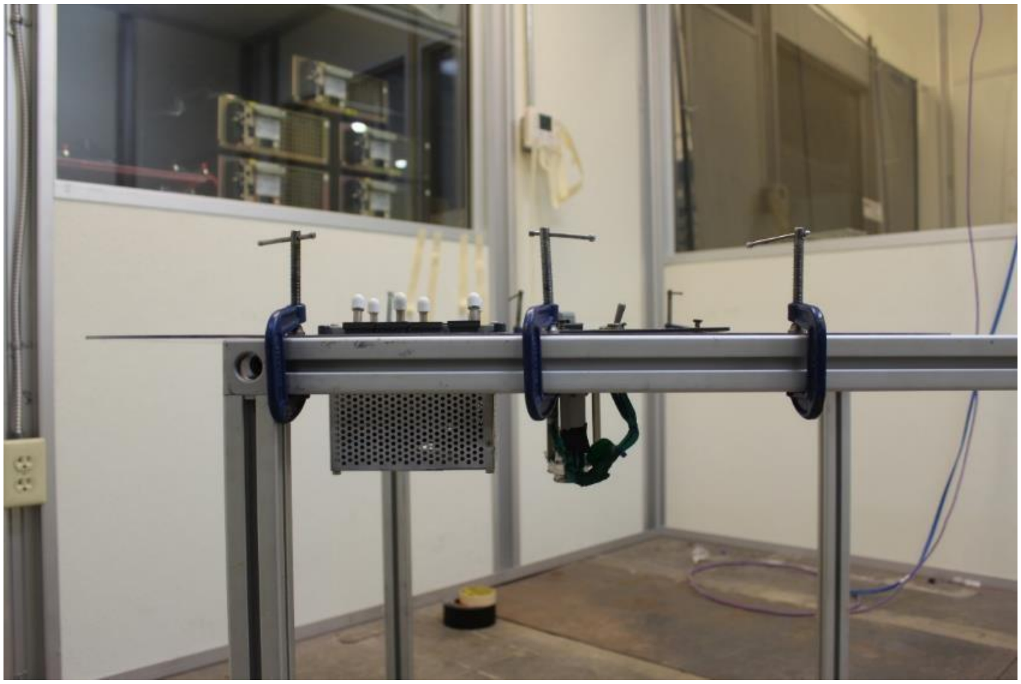

Figure 5. Fogging setup – side view

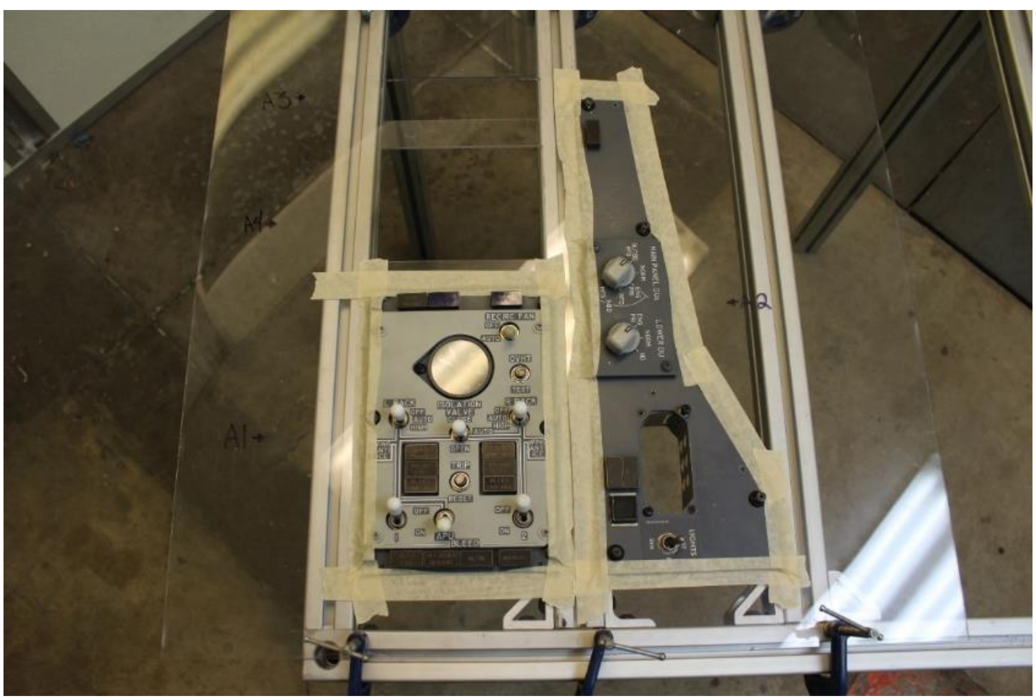

Figure 6. Fogging setup – taped top view

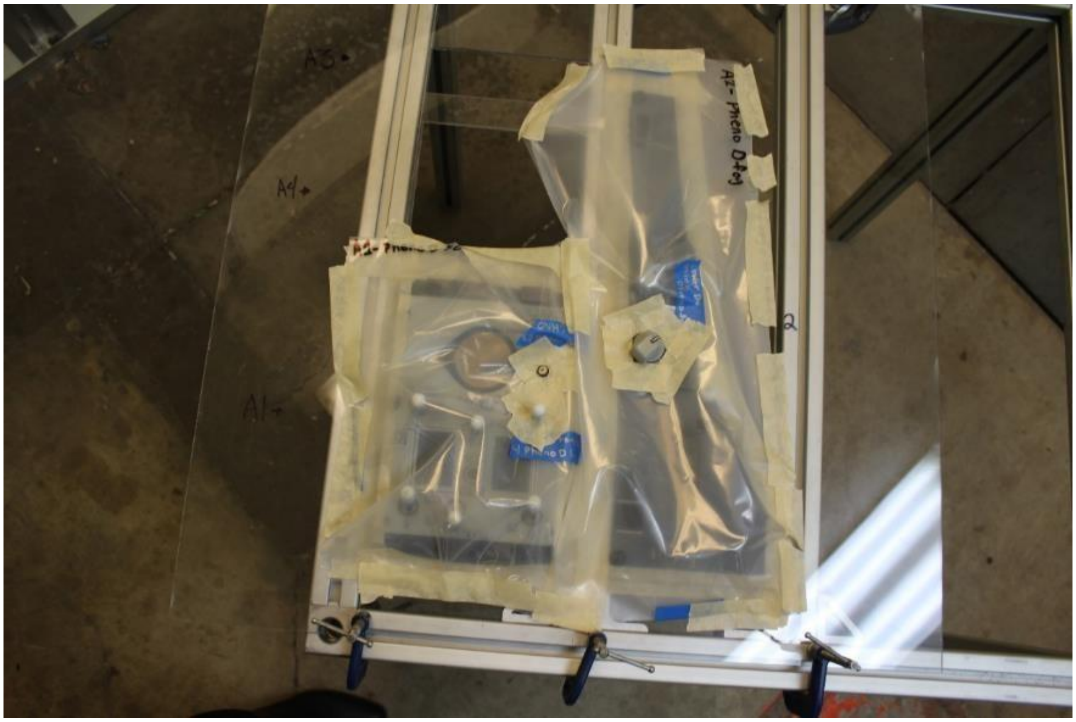

Figure 7. Fogging setup – mask application

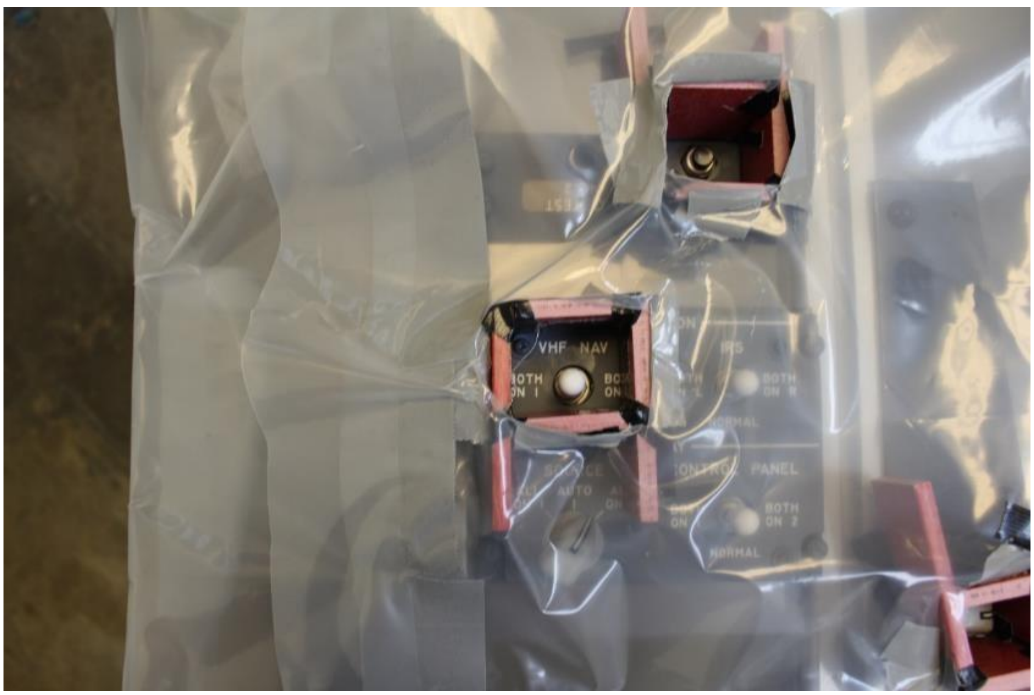

Figure 8. Spraying setup – updated mask LRU A3

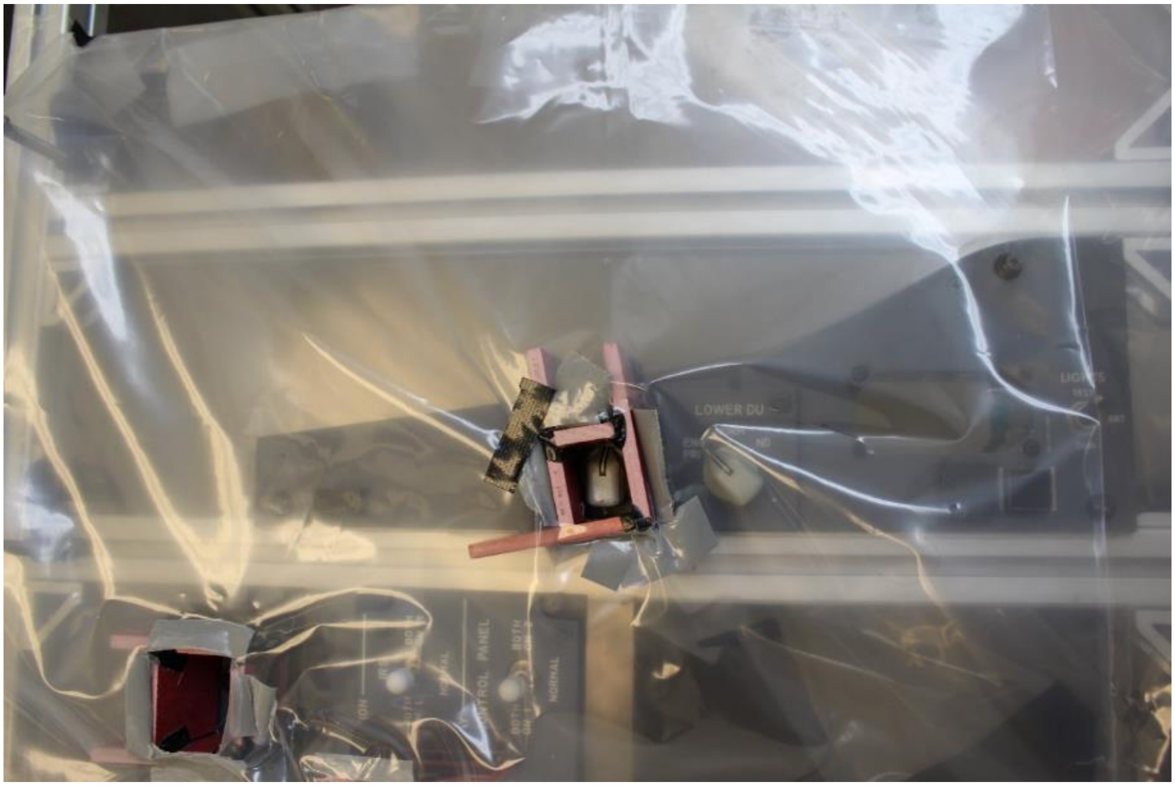

Figure 9. Spraying setup – updated mask LRU A1

4.2 Wiping method

The goal of the wiping conditioning was to simulate the real world application of the chemical disinfectants on flight deck materials by wiping the test articles by hand. The test articles were laid on a flat table and grouped by material and disinfectant. Small fans with no heating elements were used to accelerate the drying time between cycles. Specimens were wiped with a microfiber cloth which was saturated with disinfectant. The wiping conditioning was repeated for 1000 cycles and the microfiber cloths were re-saturated as needed. In between conditioning cycles there was an observed drying period of either 10 minutes or until the specimens were visibly dry, whichever came first. Only the front face of the test article was wiped. Figure 10 through Figure 12 show the general wiping conditioning setup for the plastic and coating test articles. The LRUs utilized the same conditioning setup for wiping as was used for the fogging and spraying methods.

Figure 10. Wiping setup – DMA & coating specimens

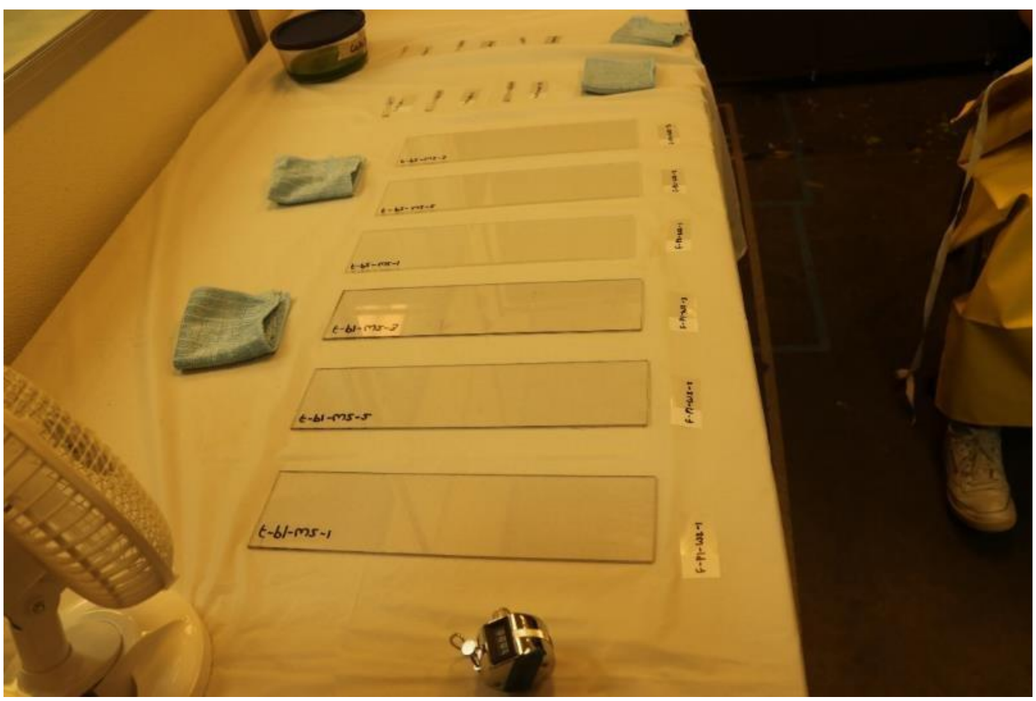

Figure 11. Wiping setup – flammability specimens

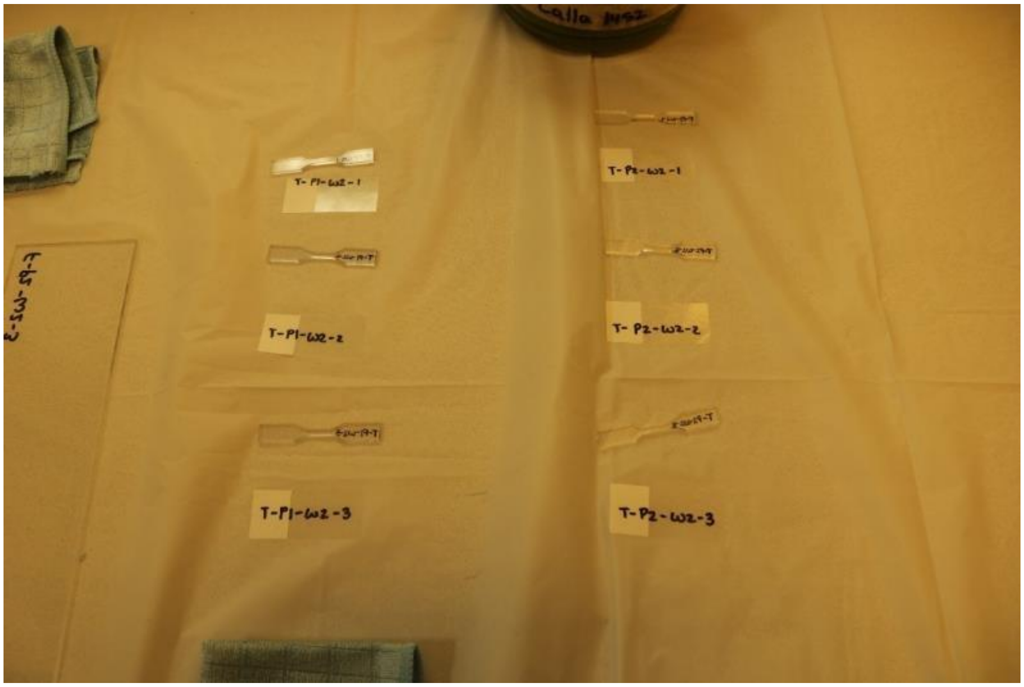

Figure 12. Wiping setup – tensile specimens

4.3 UV-C method

The objective of the UV-C conditioning method was to simulate another form of disinfection used in aircraft. This was accomplished by subjecting the test articles to different wavelengths of UV-C light for different accelerated equivalent times. The test articles were conditioned by Aero HygenX in Ontario, Canada. The test articles were conditioned under ambient conditions. The test articles were placed in the test beds centered underneath their respective UV-C light sources. At the lamp, ozone was monitored and filtered. Additionally, ozone formation at the test article was measured for the 222 nm wavelength, and no ozone was detected at any test article. The temperature inside the test bed and the average irradiance were monitored throughout the conditioning process. Once conditioning was complete, the test articles were sent back to National Institute for Aviation Research (NIAR) Environmental Test Laboratory (ETL), in Wichita, KS, where they were weighed, photographed, and tested for changes to the predetermined parameters.

The UV-C conditioning was done in two rounds. The first round subjected all of the test articles to a simulated four years of UV-C exposure at a rate of one cycle per day. As shown in the flow charts in Figure 2 and Figure 3, the accelerated equivalent exposure time for the second round of UV-C conditioning depended on the post-conditioning test results from the first round of exposure. The conditioning time in the second round was specific to each configuration (combination of test article material type and wavelength).

If no significant change was observed in any of the test results (weight, visual, tensile, flammability, glass transition temperature, oleophobicity, or haziness) after the four year exposure in round one, a new set of equivalent un-conditioned test articles were exposed to an increased duration of eight years of UV-C disinfection in round two.

If a significant change was observed in any of the test results after the four year exposure in round one, a new set of equivalent un-conditioned test articles were exposed to a reduced duration of only one year of UV-C disinfection in round two.

Figure 13 through Figure 15 show the different test beds used to condition the test articles. Table 3 lists the duration of exposure, distance, and irradiance for each of the different UV-C configurations.

Figure 13. 222 nm test bed

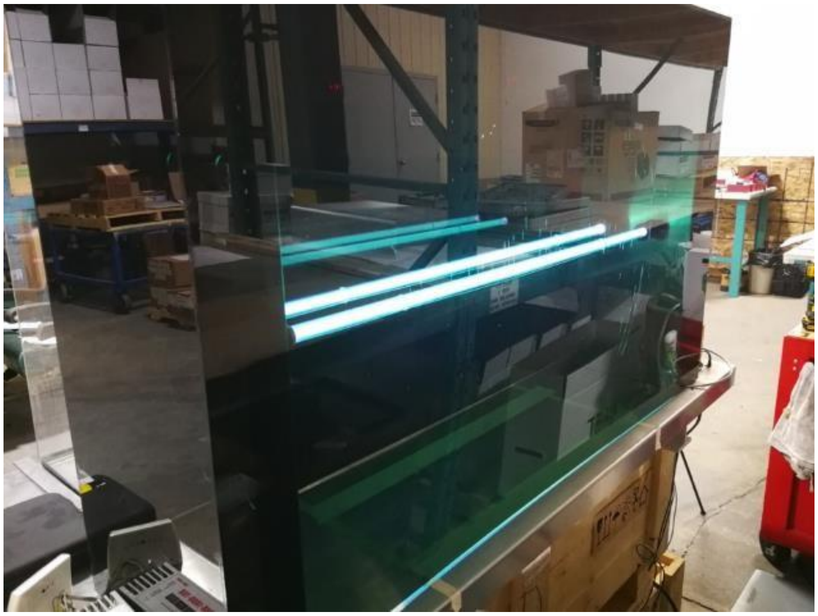

Figure 14. 254 nm test bed

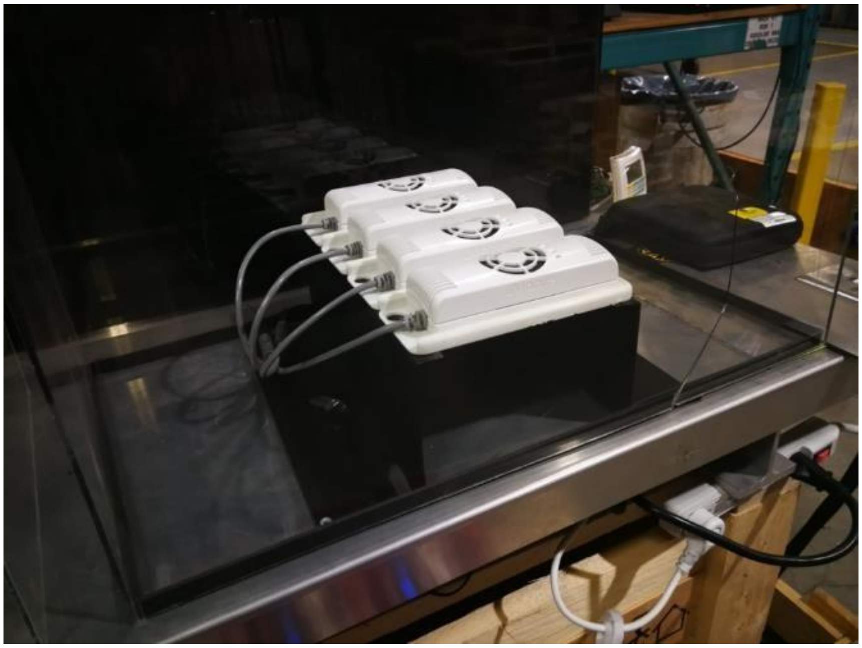

Figure 15. 280 nm test bed

Table 3. UV-C parameters

UV-C Configuration	Distance (cm)	Duration (min)	Irradiance (mW/cm^2)
222 nm – 1 year	6.5	22.97	0.794
222 nm – 4 year	6.5	78.60	0.929
222 nm – 8 year	6.5	183.77	0.794
254 nm – 1 year	37	46.04	5.285
254 nm – 4 year	37	248.14	3.923
254 nm – 8 year	37	368.34	5.285
280 nm – 1 year	11	99.26	2.298
280 nm – 4 year	11	405.64	2.250
280 nm – 8 year	11	794.08	2.298

5 Anomalies

The following lists contains all UV-C conditioning anomalies. The test results of these anomalous test articles can be referenced in section 6.4 for tensile testing, section 7.4 for flammability testing, section 8.1 for weight measurements, section 8.2 for visual changes, and section 9.1.3 for glass transition temperature.

- The Lexan™ 9600 test articles designated for 222 nm of UV-C light exposure should have been conditioned for a one year duration in the second round, but were conditioned for an eight year duration. Because of this, no data was captured and no analysis was performed for one year of UV-C exposure for this test article configuration.

- The Lexan™ 9600 test articles designated for 280 nm of UV-C light exposure should have been conditioned for a one year duration in the second round, but were conditioned for an eight year duration. Because of this, no data was captured and no analysis was performed for one year of UV-C exposure for this test article configuration.

- The poly II acrylic test articles designated for 222 nm of UV-C light exposure should have been conditioned for a one year duration in the second round, but were conditioned for an eight year duration. Because of this, no data was captured and no analysis was performed for one year of UV-C exposure for this test article configuration.

- The Lexan™ flammability test articles designated for 280 nm of UV-C light exposure should have been conditioned for eight years in the second round, but were conditioned for one year. Because of this, no data was captured and no analysis was performed for eight years of UV-C exposure for this test article configuration.

- The poly II acrylic flammability test articles designated for 280 nm of UV-C light exposure should have been conditioned for one year in the second round, but were conditioned for eight years. Because of this, no data was captured and no analysis was performed for one year of UV-C exposure for this test article configuration.

The following lists contains all tensile testing anomalies.

- Data was not captured for the tensile strength or failure strain parameters on the poly II acrylic test articles conditioned with one year of 280 nm or four years of 222 nm UV-C light exposure, so no analysis was performed for these configurations.

The following lists contains all anomalies related to the functional checks of the LRUs.

- LRUs were not evaluated for functionality in the flight simulator before being conditioned. Since there was no baseline measurement for comparison, LRUs that failed the simulator check post-conditioning would not yield any usable data, however, if the units that passed the simulator check were assumed to have had no significant change to functionality as a result of conditioning.
- The forward panel assembly (A2) and instrument switching unit (A4) did not fit in the flight simulator and were not assessed post-conditioning.

6 Tensile properties

To evaluate the tensile strength of the plastic test articles after conditioning, uniaxial tensile testing was conducted. The details of the test method and experimental observations are discussed in this section. The plastic specimens were conditioned using the wiping and UV-C conditioning methods.

6.1 Specimen dimensions and nomenclature

Test articles were manufactured from bulk plastic sheets in accordance of ASTM D638 Type V by NIAR. Type V of the ASTM standard was decided based on the thickness of the plastic sheet. The specimen geometry of ASTM D638 Type V is shown in Figure 16. The nominal dimensions of the specimen geometry are summarized in Table 4. Dimensions of all test articles were measured and summarized in Appendix A.

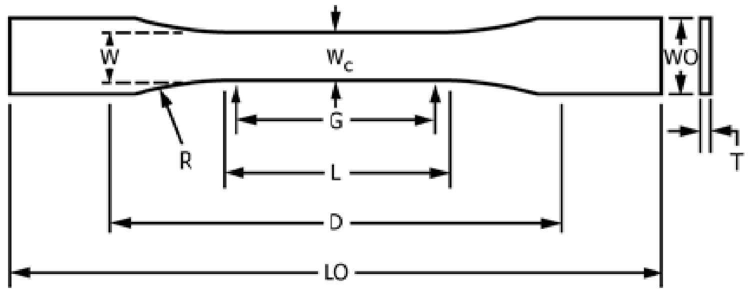

Figure 16. Tensile test article dimension key

Table 4. Tensile strength test article nominal dimensions, Type V (thickness 0.16” or under)

Length Overall [LO], in	2.500
Length of Narrow Section [L], in	0.375
Gage length [G], in	0.300
Width Overall [WO], in	0.375
Width Narrow Section [W], in	0.125
Distance Between Drips [D], in	1.000
Radius of Filler [R], in	0.500

In order to facilitate test article identification and traceability, the following nomenclature was implemented [A-B-C-D]. Table 5 summarizes the specimen identification nomenclature used for the different plastic test articles.

Table 5. Specimen ID nomenclature for tensile strength characterization

Section of Sequence	Abbreviation	Details
A [This code denoted the testing that the test article were subjected to]	T	ASTM D638- Tensile
B [This code denoted the specific material the test article was made of	P1	Lexan™ 9600
	P2	Poly II Acrylic
C [This code denoted the specific disinfectant assigned to the test article for conditioning]	C	Control (No Disinfectant)
	W1	70% IPA (Wipe)
	W2	Calla® 1452 (Wipe)
	W3	Sani-Cide EX3 (Wipe)
	W4	PREempt™ RTU (Wipe)
	W5	Bactrokill + (Wipe)
	U1	222 nm -1 or 8 years (UV-C)
	U2	254 nm - 1 or 8 years (UV-C)
	U3	280 nm - 1 or 8 years (UV-C)
	U4	222 nm - 4 years (UV-C)
	U5	254 nm - 4 years (UV-C)
	U6	280 nm - 4 years (UV-C)
D [This code denoted the instance of test article within a specific configuration]	1	Test Article 1
	2	Test Article 2
	3	Test Article 3

6.2 Test setup

Testing was carried out by the NIAR Advanced Virtual Engineering and Testing Lab in Wichita, KS. Tensile tests were conducted at ambient room temperature under displacement control at a nominal displacement rate of 0.05 in/min. Digital image correlation (DIC), a non-contact strain measurement technique, was implemented to measure the longitudinal strains. The DIC equipment is shown in Figure 17. All tests were conducted until rupture. The test apparatus used was an electrodynamic test load frame with a static load capacity of 450 lbf.

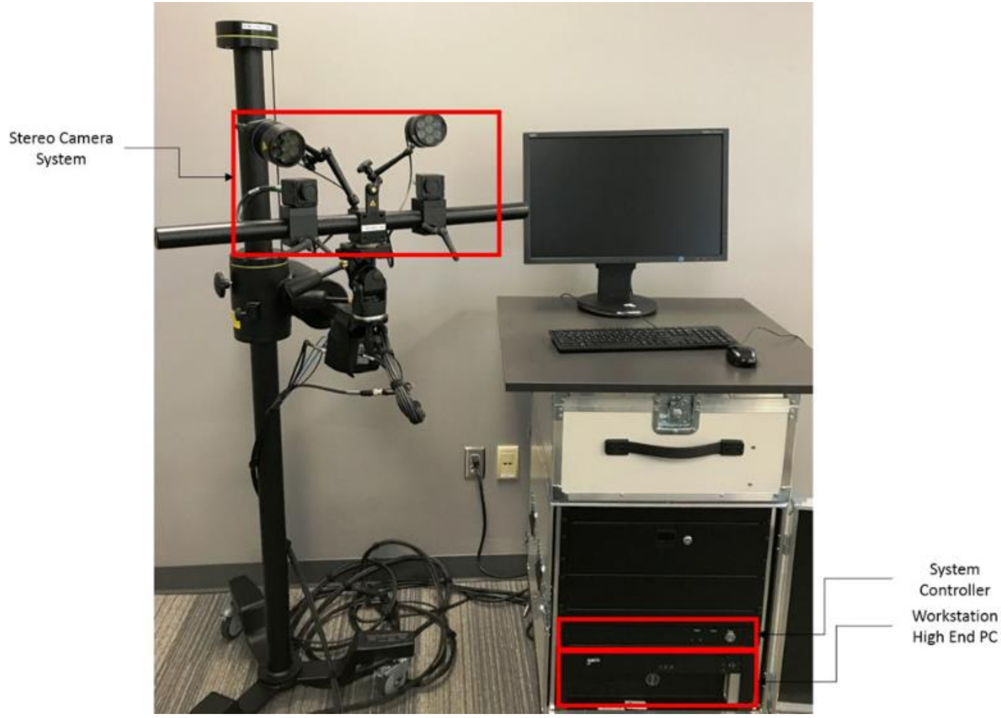

Figure 17. DIC equipment – ARAMIS 6M

6.3 Test matrix

Uniaxial tension tests were conducted on two different plastics types in accordance with ASTM D638. There were three test articles tested per configuration. The test matrix for chemical disinfectants is shown in Table 6, and the test matrix for UV-C disinfectants is shown in Table 7.

Table 6. Matrix of test articles for tensile strength characterization of plastics conditioned with chemical disinfection

Plastic Type	**Test Standard**	**Chemical Disinfectant Type**					
		Control	**70% IPA**	**Calla® 1452**	**Sani-Cide EX3**	**Bactrokill +**	**PREempt™ RTU**
Lexan™ 9600	ASTM D638	x3	x3	x3	x3	x3	x3
Poly II Acrylic		x3	x3	x3	x3	x3	x3

Table 7. Matrix of test articles for tensile strength characterization of plastics conditioned with UV-C disinfection

Plastic Type	Test Standard	UV-C Disinfectant Type						
		Control	222 nm Round 1 (4 years)	254 nm Round 1 (4 years)	280 nm Round 1(4 years)	222 nm Round 2 (1 or 8 years)	254 nm Round 2 (1 or 8 years)	280 nm Round 2 (1 or 8 years)
Lexan™ 9600	ASTM D638	x3	x3	x3	x3	x3	x3	x3
Poly II Acrylic		x3	x3	x3	x3	x3	x3	x3

6.4 Test results

For all measured test criteria, a significant change is defined as an average change in value of 15% or more compared to the average of the results of the control specimens. All test articles were tested until rupture. Table 8 through Table 11 contain the average percent change of tensile properties resulting from disinfection of each plastic type. Test data for tensile testing can be referenced in Appendix C. Appendix C also contains pre-test and post-test pictures of all test articles, as well as longitudinal stress-strain plots and comparison of yield stress, tensile strength, and failure strain for all plastics.

Table 8: Average percent change in tensile properties of Lexan™ 9600 conditioned with chemical disinfectants

Parameter	Average control value	Average percent change				
		70% IPA	Calla® 1452	Sani-Cide EX3	PREempt™ RTU	Bactrokill +
Yield stress	9497.7 psi	-3%	-1%	0%	-1%	-3%
Strain at yield	0.0621 in/in	-2%	2%	6%	1%	3%
Modulus	344.47 ksi	-5%	-1%	-2%	1%	-1%
Tensile strength	8854.6 psi	10%	9%	16%	10%	5%
Failure strain	0.9423 in/in	22%	13%	28%	13%	11%

Note. Orange indicates a 15% or more change. Blue indicates a change less than 15%.

Table 9: Average percent change in tensile properties of poly II acrylic conditioned with chemical disinfectants

Parameter	**Average control value**	**Average percent change**				
		70% IPA	**Calla® 1452**	**Sani-Cide EX3**	**PREempt™ RTU**	**Bactrokill +**
Yield stress	11046.1 psi	0%	-1%	-4%	0%	-1%
Strain at yield	6.63 in/in	-8%	-2%	2%	0%	-10%
Modulus	434.7 ksi	1%	0%	-2%	1%	-1%
Tensile strength	10205.2 psi	5%	-5%	-16%	-11%	5%
Failure strain	12.00 in/in	-28%	12%	78%	54%	-33%

Note. Orange indicates a 15% or more change. Blue indicates a change less than 15%.

Table 10: Average percent change in tensile properties of Lexan™ 9600 conditioned with UV-C

Parameter	**Average control value**	**Average percent change**					
		222 nm (4 years)	**254 nm (4 years)**	**280 nm (4 years)**	**222 nm (8 years)**	**254 nm (1 year)**	**280 nm (8 years)**
Yield stress	9497.7 psi	-1%	-2%	-4%	0%	-1%	-3%
Strain at yield	6.2 in/in	1%	-1%	3%	6%	1%	4%
Modulus	344.5 ksi	-3%	0%	-2%	0%	-1%	-3%
Tensile strength	8854.6 psi	2%	-1%	1%	-2%	-2%	-5%
Failure strain	94.2 in/in	3%	5%	6%	-2%	0%	-4%

Note. Blue indicates a change less than 15%.

Table 11: Average percent change in tensile properties of poly II acrylic conditioned with UV-C

Parameter	**Average control value**	**Average percent change**					
		222 nm (4 years)	**254 nm (4 years)**	**280 nm (4 years)**	**222 nm (8 years)**	**254 nm (1 year)**	**280 nm (1 year)**
Yield stress	11046.1 psi	-3%	-51%	3%	1%	7%	4%
Strain at yield	6.63 in/in	-38%	-81%	-11%	-38%	-1%	-7%
Modulus	434.7 ksi	1%	12%	12%	21%	17%	16%
Tensile strength	10205.2 psi	NA	NA	8%	9%	14%	13%
Failure strain	12.0 in/in	NA	NA	-36%	-66%	-29%	-45%

Note. Orange indicates a 15% or more change. Blue indicates a change less than 15%.

6.5 Summary of tensile testing

Tensile testing was performed according to ASTM D638 Type IV on three test articles per material per disinfectant as laid out in Table 6. Table 12 and Table 13 summarize whether there was a change in any of the given test parameters. The cells are highlighted different colors to represent the results. For specifics regarding any changes to the test parameters of the test article refer to section 5, section 6.4, or Appendix C.

Table 12. Tensile strength results summary – wiping method

Material Name	**Disinfectant Type**				
	70% IPA	**Calla® 1452**	**Sani-Cide EX3**	**Bactrokill +**	**PREempt™ RTU**
Lexan™ 9600					
Poly II Acrylic					

Note. Orange indicates a 15% or more change. Blue indicates a change less than 15%.

Table 13. Tensile strength results summary – UV-C method

Material Name	Disinfectant Type					
	222 nm	**254 nm**	**280 nm**	**222 nm**	**254 nm**	**280 nm**
Lexan™ 9600	4 years	4 years	4 years	8 years	1 year	8 years
Poly II Acrylic	4 years	4 years	4 years	8 years	1 year	1 year

Note. Orange indicates a 15% or more change. Blue indicates a change less than 15%.

7 Flammability properties

This aspect of the project evaluated the effect that chemical and UV-C disinfection had on the flammability properties of the plastic test articles. Tests were conducted in accordance with the 60 second vertical Bunsen burner tests specified in 14 CFR §25.853 Appendix F (Federal Aviation Administration, 2011). Flammability tests were conducted at NIAR ETL. The purpose of this test was to compare the flammability performances of these materials when conditioned with various disinfectants as compared to unconditioned test articles. It is important to note that the evaluated materials typically fall under a small parts exemption for the 60 second vertical burn test method defined in 14 CFR §25.853 Appendix F. Nonetheless, this test was conducted to show the relative differences in effects resulting from each disinfectant which may not have been apparent in a less severe test method.

The data collected is not intended to be used for certification purposes, which is why it is important to identify the criteria used to measure the extent of damage due to flammability testing. The criteria were based on the conservativeness of the conditioning method and was defined as outlined below. In the cabin materials phase of this work (Bhasin, et al., 2022) (Olivares, et al., 2021), a 50% change was used to determine if a significant change had taken place however in the flight deck phase, a 15% or greater change in any of these criteria after conditioning was considered to be a significant change.

1. Flame Time: Duration the test article remained aflame after removing the flame source.
2. Drip Flame Time: Durations that drippings from the test article continue to flame after falling.
3. Burn Length: The length of damage on the test article due to flame impingement, including complete or partial consumption, charring, or embrittlement. Areas of soot, dislocation, stains, warpage, and areas that have shrunk or melted away from the heat source do not contribute to this measurement.

7.1 Specimen dimensions and nomenclature

Test articles were manufactured from bulk plastic sheets in accordance of 14 CFR §25.853 Appendix F Part 1 (a)(1)(i) (Federal Aviation Administration, 2011) by NIAR. The nominal dimensions of the specimen geometry are summarized in Table 14. Dimensions of all test articles were measured and summarized in Appendix A.

Table 14. Flammability test article nominal dimensions

Length [L], in	≤ 12.00
Width [W], in	≤ 2.00

In order to facilitate test article identification and traceability, the following nomenclature was implemented [A-B-C-D]. Table 15 summarizes the specimen identification nomenclature used for the different plastic test articles.

Table 15. Specimen ID nomenclature for flammability characterization

Section of Sequence	Abbreviation	Details
A [This code denoted the testing that the test article were subjected to]	F	14 CFR §25.853 – Flammability
B [This code denoted the specific material the test article was made of	P1	Lexan™ 9600
	P2	Poly II Acrylic
C [This code denoted the specific disinfectant assigned to the test article for conditioning]	C	Control (No Disinfectant)
	W1	70% IPA (Wipe)
	W2	Calla® 1452 (Wipe)
	W3	Sani-Cide EX3 (Wipe)
	W4	PREempt™ RTU (Wipe)
	W5	Bactrokill + (Wipe)
	U1	222 nm -1 or 8 years (UV-C)
	U2	254 nm - 1 or 8 years (UV-C)
	U3	280 nm - 1 or 8 years (UV-C)
	U4	222 nm - 4 years (UV-C)
	U5	254 nm - 4 years (UV-C)
	U6	280 nm - 4 years (UV-C)
D [This code denoted the instance of test article within a specific configuration]	1	Test Article 1
	2	Test Article 2
	3	Test Article 3

7.2 Test setup

Vertical flammability testing was conducted by NIAR ETL and per 14 CFR §25.853 Appendix F Part 1 (a) (1) (1) (Federal Aviation Administration, 2011). Figure 18 shows the general test setup used to conduct flammability testing (United States Federal Aviation Administration, 2010).

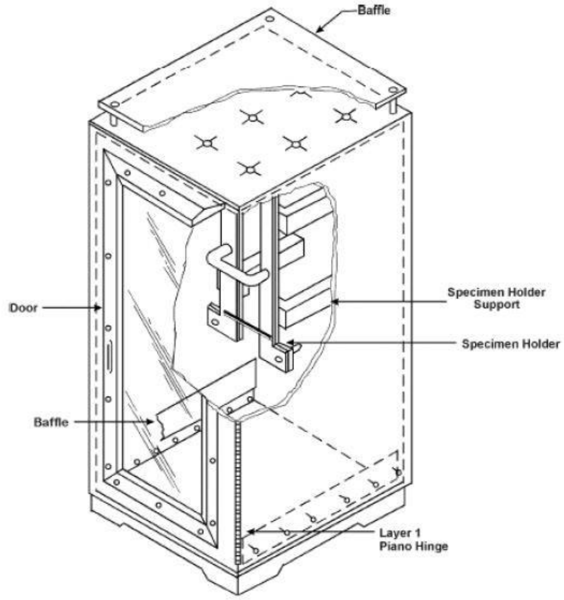

Figure 18. Flammability general test setup without pressure/vacuum of airflow

7.3 Test matrix

Vertical flammability tests were conducted on two different plastics in accordance with 14 CFR §25.853 Appendix F Part 1 (a) (1) (1). For each plastic type, three test articles were tested per chemical disinfectant type as shown in Table 16. For each plastic type, three test articles were tested per UV-C disinfectant type as shown in Table 17.

Table 16. Matrix of test articles for flammability of plastics conditioned with chemical disinfection

Plastic Type	**Test Standard**	**Chemical Disinfectant Type**					
		Control	**70% IPA**	**Calla® 1452**	**Sani-Cide EX3**	**Bactrokill +**	**PREempt™ RTU**
Lexan™ 9600	ASTM D638	x3	x3	x3	x3	x3	x3
Poly II Acrylic		x3	x3	x3	x3	x3	x3

Table 17. Matrix of test articles for flammability of plastics conditioned with UV-C disinfection

Plastic Type	Test Standard	UV-C Disinfectant Type						
		Control	222 nm Round 1 (4 years)	254 nm Round 1 (4 years)	280 nm Round 1 (4 years)	222 nm Round 2 (1 or 8 years)	254 nm Round 2 (1 or 8 years)	280 nm Round 2 (1 or 8 years)
Lexan™ 9600	ASTM D638	x3	x3	x3	x3	x3	x3	x3
Poly II Acrylic		x3	x3	x3	x3	x3	x3	x3

7.4 Test results

Tables containing the flame time, burn length, and drip flame time for each of the test articles can be found in Table 18 through Table 21. For all measured test criteria, a significant change is defined as an average change value of 15% or more compared to the average of the results from the three control specimens. It should be noted that there was a large amount of scatter in the flame time of the Lexan™ 9600 control specimens so all conditioned Lexan™ 9600 test articles registered a very large change in this parameter as detailed below. No statistical analysis was done as three data points is not enough. The full test data and plots of the results can be found in Appendix D . Post-test pictures of all test articles are located in Appendix D.

Table 18: Average percent change in flammability properties of Lexan™ 9600 conditioned with chemical disinfectants

Parameter	Average control value	Average percent change				
		70% IPA	Calla® 1452	Sani-Cide EX3	PREempt™ RTU	Bactrokill +
Flame time	7.33 s	-55%	-100%	-100%	-50%	-73%
Drip time	0.00 s	0%	0%	0%	0%	0%
Burn length	3.13 in	4%	-12%	-7%	-1%	-7%

Table 19: Average percent change in flammability properties of poly II acrylic conditioned with chemical disinfectants

Parameter	**Average control value**	**Average percent change**				
		70% IPA	**Calla® 1452**	**Sani-Cide EX3**	**PREempt™ RTU**	**Bactrokill +**
Flame time	288.00 s	-24%	-25%	-29%	-30%	6%
Drip time	0.00 s	0%	0%	0%	0%	0%
Burn length	11.50 in	2%	1%	3%	3%	3%

Table 20: Average percent change in flammability properties of Lexan™ 9600 conditioned with UV-C

Parameter	**Average control value**	**Average percent change**					
		222 nm (4 years)	**254 nm (4 years)**	**280 nm (4 years)**	**222 nm (8 years)**	**254 nm (1 year)**	**280 nm (1 year)**
Flame time [s]	7.33 s	-100%	-100%	-100%	-86%	-5%	-77%
Drip time [s]	0.00 s	0%	0%	0%	0%	0%	0%
Burn length	3.13 in	-9%	-9%	-15%	-4%	-4%	-7%

Table 21: Average percent change in flammability properties of poly II acrylic conditioned with UV-C

Parameter	**Average control value**	**Average percent change**					
		222 nm (4 years)	**254 nm (4 years)**	**280 nm (4 years)**	**222 nm (8 years)**	**254 nm (1 year)**	**280 nm (8 year)**
Flame time	288.00 s	-33%	-29%	-29%	-8%	-11%	-5%
Drip time	0.00 s	0%	0%	0%	0%	0%	0%
Burn length	11.50 in	2%	4%	3%	3%	4%	3%

7.5 Summary of flammability testing

To further understand how chemical and UV-C disinfection affects the vertical flammability of plastics, test articles were conditioned according to either the wiping method outlined in section 4.2 or the UV-C conditioning method outlined in section 4.3, and tested per the setup detailed in section 7.2. Overall, the test articles that showed a significant change in any parameter after conditioning showed an improved performance over the control specimen in terms of flammability testing. A summary of the results of the testing can be found in Table 22 and Table 23, where the cells are highlighted different colors to represent the results. For further details on the specifics of each test article's results refer to section 7.4.

Table 22. Flammability results summary – wiping method

Material Type	**Disinfectant**				
	70% IPA	**Calla® 1452**	**Sani-Cide EX3**	**PREempt™ RTU**	**Bactrokill +**
Lexan™ 9600					
Poly II Acrylic					

Note. Orange indicates a 15% or more change. Blue indicates a change less than 15%.

Table 23. Flammability results summary – UV-C method

Material Type	Disinfectant					
	222 nm	254 nm	280 nm	222 nm	254 nm	280 nm
Lexan™ 9600	4 years	4 years	4 years	8 years	1 year	1 years
Poly II Acrylic	4 years	4 years	4 years	8 years	1 year	8 years

Note. Orange indicates a 15% or more change. Blue indicates a change less than 15%.

8 Physical properties – weight, visual, and functionality

The effect of chemical and UV-C disinfectants on the test articles were also evaluated for any weight and visual changes. The details of the test methods and the observations are discussed in the following section.

8.1 Weight measurements

Weight was measured to an accuracy of 0.01 g before and after conditioning with each disinfectant type. Weight measurements for all test articles are summarized in Table 24 through Table 31 by and organized by disinfection method. No significant change in weight was observed for any of the test articles after conditioning.

Table 24. Weight change comparison of LRUs – fogging method and spraying methods

LRU Test Article	Check-In Weight (g)	Percent Change	
		Pheno D - Fogging Method	Calla® 1452 - Spraying Method
LRU 1 (A1)	2060.00	0%	N/A
LRU 2 (A2)	1027.50	-1%	0%
LRU 3 (A3)	137.50	N/A	-1%
LRU 4 (A4)	642.00	N/A	0%

Note. Blue indicates a change less than 15%.

Table 25. Weight change comparison of LRUs – wiping method

LRU Test Article	Check-In Weight (g)	Percent Change				
		70% IPA	Calla® 1452	Sani-Cide EX3	PREempt™ RTU	Bactrokill +
LRU 1 (A1)	2060.00	0%	N/A	0%	Data not captured	0%
LRU 2 (A2)	1027.50	N/A	0%	N/A	N/A	N/A
LRU 3 (A3)	137.50	N/A	0%	N/A	N/A	N/A
LRU 4 (A4)	642.00	N/A	0%	N/A	N/A	N/A

Note. Blue indicates a change less than 15%

Table 26. Weight change comparison of plastic test articles – wiping method

Plastic Type	Coupon Type	Average Control Weight (g)	Percent Change				
			70% IPA	Calla® 1452	Sani-Cide EX3	PREempt ™ RTU	Bactrokill +
Lexan™ 9600	Tensile	1.41	-2%	0%	0%	0%	0%
	DMA	16.72	0%	2%	3%	3%	2%
	Flam.	68.25	0%	0%	1%	1%	-1%
Poly II Acrylic	Tensile	1.37	0%	0%	0%	1%	0%
	DMA	17.99	0%	-1%	-2%	-2%	-4%
	Flam.	74.19	-1%	-3%	-5%	-8%	-6%

Note. Blue indicates a change less than 15%.

Table 27. Weight change comparison of coating test articles – wiping method

Coating Type	Average Control Weight (g)	Percent Change				
		70% IPA	Calla® 1452	Sani-Cide EX3	PREempt ™ RTU	Bactrokill +
Antireflective/ Antiglare/ Oleophobic Coating A (C1)	2.81	2%	3%	3%	4%	4%
Oleophobic Coating B (C2)	10.44	1%	0%	0%	1%	0%
Oleophobic Coating C (C3)	10.46	0%	1%	0%	1%	1%
Oleophobic Coating D (C4)	10.64	0%	-1%	0%	-1%	0%

Coating Type	Average Control Weight (g)	Percent Change				
		70% IPA	Calla® 1452	Sani-Cide EX3	PREempt™ RTU	Bactrokill +
Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A (C5)	2.55	0%	3%	5%	0%	3%
Antireflective/ Conductive Coating (C6)	10.16	0%	0%	0%	0%	0%

Note. Blue indicates a change less than 15%.

Table 28. Weight change comparison of plastics – UV-C method – Round 1

Plastic Type	Coupon Type	Average Control Weight (g)	Percent Change		
			222 nm (4 years)	254 nm (4 years)	280 nm (4 years)
Lexan™ 9600	Tensile	1.41	-1%	0%	0%
	DMA	16.72	2%	2%	3%
	Flammability	68.25	0%	0%	0%
Poly II Acrylic	Tensile	1.37	0%	0%	0%
	DMA	17.99	-4%	-4%	-4%
	Flammability	74.19	-5%	-5%	-4%

Note. Blue indicates a change less than 15%

Table 29: Weight change comparison of plastics – UV-C Method – Round 2

Plastic Type	**Coupon Type**	**Average Control Weight (g)**	**Percent Change**					
			222 nm (1 year)	**254 nm (1 year)**	**280 nm (1 year)**	**222 nm (8 years)**	**254 nm (8 years)**	**280 nm (8 years)**
Lexan 9600	Tensile	1.41	N/A	0%	N/A	-2%	N/A	2%
	DMA	16.72	N/A	2%	N/A	2%	N/A	3%
	Flammability	68.25	N/A	-2%	-1%	-1%	N/A	N/A
Poly II Acrylic	Tensile	1.37	N/A	-1%	-1%	-1%	N/A	N/A
	DMA	17.99	N/A	-3%	-5%	-3%	N/A	N/A
	Flammability	74.19	N/A	1%	N/A	-4%	N/A	0%

Note. Orange indicates a 15% or more change. Blue indicates a change less than 15%

Table 30. Weight change comparison of coatings – UV-C method – Round 1

Coating Type	**Average Control Weight (g)**	**Percent Change**		
		222 nm (4 years)	**254 nm (4 years)**	**280 nm (4 years)**
Antireflective/ Antiglare/ Oleophobic Coating A (C1)	2.81	5%	4%	2%
Oleophobic Coating B (C2)	10.44	0%	1%	1%
Oleophobic Coating C (C3)	10.46	0%	0%	1%
Oleophobic Coating D (C4)	10.64	0%	0%	-1%
Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A (C5)	2.55	0%	2%	2%
Antireflective/ Conductive Coating (C6)	10.16	0%	0%	0%

Note. Orange indicates a 15% or more change. Blue indicates a change less than 15%

Table 31: Weight change comparison of coatings – UV-C method – Round 2

Material	**Average Control Weight (g)**	**Percent Change**					
		222 nm (1 year)	**254 nm (1 year)**	**280 nm (1 year)**	**222 nm (8 years)**	**254 nm (8 years)**	**280 nm (8 years)**
Antireflective / Antiglare / Oleophobic Coating A	2.81	N/A	N/A	N/A	4%	3%	4%
Oleophobic Coating B	10.44	0%	N/A	N/A	N/A	1%	1%
Oleophobic Coating C	10.46	1%	1%	N/A	N/A	N/A	0%
Oleophobic Coating D	10.64	-1%	-1%	0%	N/A	N/A	N/A
Antireflective / Antiglare / Conductive / Oleophobic Coating A	2.55	N/A	N/A	N/A	-1%	-1%	0%
Antireflective / Conductive Coating	10.16	0%	0%	N/A	N/A	N/A	0%

Note. Blue indicates a change less than 15%

8.2 Visual and functionality evaluation

For this research project, the visual changes to the materials were evaluated qualitatively by comparing any notable changes to the specimen's appearance before and after conditioning. All test articles were evaluated for local discoloration and visible residue. The LRUs were additionally evaluated for any paint damage, label damage, or noted change in functionality or texture. Changes in functionality were determined by performing a mechanical check immediately following the end of conditioning followed by placing the units back into the flight simulator to ensure proper powered function. Mechanical functional checks were completed by comparing the conditioned portions of the LRUs to the designated control portions. The simulation checks were completed by running flight simulations on the LRUs.

Table 32 and Table 33 summarize the noted visual changes to the LRU test articles that underwent the fogging and spraying conditioning respectively. Table 34 through Table 41 summarize the noted visual changes to the test articles that underwent the wiping conditioning. Table 37 and Table 38 summarize the noted visual changes to the LRU test articles that underwent the UV-C conditioning.

Table 32. Visual change to LRUs – fogging method with Pheno D

LRU Test Article	**Noted Visual Change**					**Simulation Notes**
	Local Discoloration	**Paint Damage**	**Label Damage**	**Visible Residue**	**Mechanical Notes**	
LRU 1 (A1)	No	No	No	No	No Change	Failed Simulation Check
LRU 2 (A2)	No	No	No	Yes	Transparent residue left on the labels & surface of A2 around LOWER DU knob.	Data Not Collected

Note. Orange indicates a change. Blue indicates no change.

Table 33. Visual change of LRUs – spraying method with Calla® 1452

LRU Test Article	**Noted Visual Change**					**Simulation Notes**
	Local Discoloration	**Paint Damage**	**Label Damage**	**Visible Residue**	**Mechanical Notes**	
LRU 1 (A1)	No	No	No	Yes	Main panel DU's knob was slightly harder to turn than original condition.	N/A
LRU 2 (A2)	No	No	No	Yes	No Change	Data Not Captured
LRU 3 (A3)	Yes	No	No	Yes	Evidence the disinfectant seeped through top of panel. Rust observed on the VHF N/AV toggle switch. The inside of the panel appeared wet from disinfectant. The red label leached color onto operator gloves while wet. No change in switch mechanism.	Passed Simulation Check
LRU 4 (A4)	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured

Note. "Data not captured" for the simulation notes indicates that the LRU was not compatible with the flight simulation setup. Orange indicates a change. Blue indicates no change.

Table 34. Visual change to LRUs – wiping method

LRU Test Article	Disinfectant	Noted Visual Change					
		Local Discoloration	Paint Damage	Label Damage	Visible Residue	Mechanical Notes	Simulation Notes
LRU 1 (A1)	70% IPA	No	No	No	No	No Change	Failed Simulation Check
LRU 1 (A1)	Sani-Cide EX3	Yes	No	No	Yes	No functional change to push buttons, a visible residue was noted. No visible residue to toggle switches, but there was evidence of oxidation. Additionally, there was a slight change in functionality to the toggle switch.	Failed Simulation Check
LRU 1 (A1)	PREempt™ RTU	N/A	N/A	N/A	N/A	N/A	Failed Simulation Check
LRU 1 (A1)	Bactrokill +	Yes	No	No	No	No mechanical change to push button. No mechanical change to toggle switch, but evidence of corrosion and local discoloration.	Failed Simulation Check
LRU 2 (A2)	Calla® 1452	No	No	No	Yes	No change	Data Not Collected
LRU 3 (A3)	Calla® 1452	Yes	Yes	No	Yes	Visible evidence of residue on surface. Disinfectant crystalized on surface. Paint damage on washer. No mechanical change.	Data Not Collected
LRU 4 (A4)	Calla® 1452	Yes	No	No	No	No change to mechanism. Navigation IRS toggle was stiffer to maneuver.	Data Not Collected

Note. "Data not captured" for the simulation notes indicates that the LRU was not compatible with the flight simulation setup. Orange indicates a change. Blue indicates no change.

Table 35. Visual change to plastic test articles – wiping method

Plastic Type	Disinfectant	Noted Visual Change		
		Discoloration	Visible Residue	Notes
Lexan™ 9600	70% IPA	No	No	No change
	Calla® 1452	No	No	No change
	Sani-Cide EX3	No	Yes	Sticky to the touch and had a visible residue.
	PREempt™ RTU	No	Yes	Had a noted residue.
	Bactrokill +	No	No	No change
Poly II Acrylic	70% IPA	No	No	No change
	Calla® 1452	No	No	No change
	Sani-Cide EX3	No	Yes	Sticky to the touch and had a visible residue.
	PREempt™ RTU	No	Yes	Had a noted residue.
	Bactrokill +	No	No	No change

Note. Orange indicates a change. Blue indicates no change.

Table 36. Visual change to display coating test articles – wiping method

Coating Type	Disinfectant	Noted Visual Change		
		Discoloration	Visible Residue	Notes
Antireflective/ Antiglare/ Oleophobic Coating A (C1)	70% IPA	No	No	No change
	Calla® 1452	No	No	No change
	Sani-Cide EX3	No	Yes	Sticky to the touch and had a visible residue.
	PREempt™ RTU	No	Yes	Had a noted residue.
	Bactrokill +	No	No	No change
Oleophobic Coating B (C2)	70% IPA	No	No	No change
	Calla® 1452	No	No	No change
	Sani-Cide EX3	No	Yes	Sticky to the touch and had a visible residue.

Coating Type	Disinfectant	Noted Visual Change		
		Discoloration	Visible Residue	Notes
Oleophobic Coating B (C2)	PREempt™ RTU	No	Yes	Had a noted residue.
Oleophobic Coating B (C2)	Bactrokill +	No	No	No change
Oleophobic Coating C (C3)	70% IPA	No	No	No change
Oleophobic Coating C (C3)	Calla® 1452	No	No	No change
Oleophobic Coating C (C3)	Sani-Cide EX3	No	Yes	Sticky to the touch and had a visible residue.
Oleophobic Coating C (C3)	PREempt™ RTU	No	Yes	Had a noted residue.
Oleophobic Coating C (C3)	Bactrokill +	No	No	No change
Oleophobic Coating D (C4)	70% IPA	No	No	No change
Oleophobic Coating D (C4)	Calla® 1452	No	No	No change
Oleophobic Coating D (C4)	Sani-Cide EX3	No	Yes	Sticky to the touch and had a visible residue.
Oleophobic Coating D (C4)	PREempt™ RTU	No	Yes	Had a noted residue.
Oleophobic Coating D (C4)	Bactrokill +	No	No	No change
Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A (C5)	70% IPA	No	No	No change
Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A (C5)	Calla® 1452	No	No	No change
Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A (C5)	Sani-Cide EX3	No	Yes	Sticky to the touch and had a visible residue.
Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A (C5)	PREempt™ RTU	No	Yes	Had a noted residue.
Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A (C5)	Bactrokill +	No	No	No change
Antireflective/ Conductive Coating (C6)	70% IPA	No	No	No change
Antireflective/ Conductive Coating (C6)	Calla® 1452	No	No	No change
Antireflective/ Conductive Coating (C6)	Sani-Cide EX3	No	Yes	Sticky to the touch and had a visible residue.
Antireflective/ Conductive Coating (C6)	PREempt™ RTU	No	Yes	Had a noted residue.
Antireflective/ Conductive Coating (C6)	Bactrokill +	No	No	No change

Note. Orange indicates a change. Blue indicates no change.

Table 37. Visual change to plastic test articles – UV-C method

Plastic Type	UV-C Wavelength & Simulated Duration	Noted Visual Change		
		Discoloration	Visible Residue	Notes
Lexan™ 9600	222 nm (8 years)	No	No	No Change
	254 nm (1 year)	No	No	No Change
	280 nm (8 years)	Yes	No	A yellow tint to the test article.
	222 nm (4 years)	No	No	No Change
	254 nm (4 years)	Yes	No	A yellow tint to the test article.
	280 nm (4 years)	No	No	A yellow tint to the test article.
Poly II Acrylic	222 nm (8 years)	No	No	No Change
	254 nm (1 year)	No	No	No Change
	280 nm (1 year)	No	No	No Change
	222 nm (4 years)	No	No	No Change
	254 nm (4 years)	Yes	No	A yellow tint to the test article.
	280 nm (4 years)	No	No	No Change

Note. Orange indicates a change. Blue indicates no change.

Table 38. Visual change to display coating test articles – UV-C method

Coating Type	UV-C Wavelength & Simulated Duration	Noted Visual Change		
		Discoloration	Visible Residue	Notes
Antireflective/ Antiglare/ Oleophobic Coating A (C1)	222 nm (8 years)	Yes	No	Foggy Appearance
	254 nm (8 years)	Yes	No	Foggy Appearance
	280 nm (8 years)	No	No	No Change
	222 nm (4 years)	No	No	No Change
	254 nm (4 years)	No	No	No Change
	280 nm (4 years)	No	No	No Change
Oleophobic Coating B (C2)	222 nm (1 year)	No	No	No Change
	254 nm (8 years)	No	No	No Change

Coating Type	UV-C Wavelength & Simulated Duration	Noted Visual Change		
		Discoloration	Visible Residue	Notes
Oleophobic Coating B (C2)	280nm (1 or 8 years)	No	No	No Change
	222nm (4 years)	No	No	No Change
	254 nm (4 years)	No	No	No Change
	280 nm (4 years)	No	No	No Change
Oleophobic Coating C (C3)	222 nm (1 year)	No	No	No Change
	254 nm (1 year)	No	No	No Change
	280 nm (8 years)	No	No	No Change
	222 nm (4 years)	No	No	No Change
	254 nm (4 years)	No	No	No Change
	280 nm (4 years)	No	No	No Change
Oleophobic Coating D (C4)	222 nm (1 year)	No	No	No Change
	254 nm (1 year)	No	No	No Change
	280 nm (1 year)	No	No	No Change
	222 nm (4 years)	No	No	No Change
	254 nm (4 years)	No	No	No Change
	280 nm (4 years)	No	No	No Change
Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A (C5)	222 nm (8 years)	Yes	No	Foggy Appearance
	254 nm (8 years)	No	No	No Change
	280 nm (8 years)	No	No	No Change
	222 nm (4 years)	No	No	No Change
	254 nm (4 years)	No	No	No Change
	280 nm (4 years)	No	No	No Change
Antireflective/ Conductive Coating (C6)	222 nm (1 year)	No	No	No Change
	254 nm (1 year)	No	No	No Change
	280 nm (8 years)	No	No	No Change
	222 nm (4 years)	No	No	No Change
	254 nm (4 years)	No	No	No Change
	280 nm (4 years)	No	No	No Change

Note. Orange indicates a change. Blue indicates no change.

8.3 Summary of physical properties

- No significant change in weight was observed for any of the test articles after conditioning.
- LRUs were affected by spraying, fogging, and wiping, the majority of which caused discoloration and residue.
- The stall warning panel LRU conditioned with Calla® 1452 for both the wiping and spraying method passed the simulator functional check.
- 70% IPA wiping did not cause any notable visible changes to the test articles.
- Calla® 1452 wiping did not cause any notable visible changes to the test articles.
- Sani-Cide EX3 wiping often caused the test articles to be sticky to the touch and have a visible residue, regardless of the material type.
- PREempt™ RTU wiping often left a notable residue, regardless of the material type.
- Bactrokill + wiping did not cause any notable visible changes to the test articles.
- UV-C disinfecting with the 222 nm and 254 nm wavelengths occasionally caused a foggy appearance on the display coatings exposed for 4 or 8 years.
- UV-C disinfecting with the 254 nm and 280 nm wavelengths occasionally caused a yellow tint to appear on both plastics at varying exposure times.

9 Material properties

This research project sought to evaluate how chemical and UV-C disinfection effected the material properties of the plastic and coating test materials found in the flight deck. Dynamic material analysis (DMA), contact angle, and light transmission and haze techniques were used to evaluate any change to the glass transition temperature, oleophobicity, and optical properties respectively of the test articles after being conditioned with disinfectants. The details of each test and their results are discussed in the following sections.

9.1 Glass transition temperature

To determine the effects that chemical and UV-C disinfection had on the glass transition temperature of the plastic test articles, dynamic mechanical analysis was conducted in accordance with ASTM D4065 (American Society of Testing and Materials, 2012). DMA testing was conducted by the NIAR Composites lab in Wichita, KS. The test articles evaluated were conditioned using the wiping and UV-C methods as discussed in sections 4.2 and 4.3 respectively. The following sections discuss the details of the DMA test.

9.1.1 Specimen dimensions and nomenclature

Test articles were manufactured by NIAR from bulk plastic sheets following the nominal dimensions as detailed in Table 39. After conditioning was complete, three specimens were removed from each test article with the dimensions described in Table 40. Dimensions of test articles were measured and summarized in Appendix A.

Table 39. Nominal dimensions of test articles designated for DMA – pre-conditioned

Length [L], in	3.00 ± 0.01
Width [W], in	3.00 ± 0.01

Table 40. Nominal dimensions of DMA samples– post-conditioned/pre-test

Length [L], in	2.30
Width [W], in	0.25

In order to facilitate test article identification and traceability, the following nomenclature was implemented [A-B-C-D]. Table 41 summarizes the specimen identification nomenclature used for the plastic test articles

Table 41. Specimen ID nomenclature for DMA characterization

Section of Sequence	**Abbreviation**	**Details**
A [This code denoted the testing that the test article were subjected to]	D	ASTM D4065 (American Society of Testing and Materials, 2012)
B [This code denoted the specific material the test article was made of	P1	Lexan™ 9600
	P2	Poly II Acrylic
C [This code denoted the specific disinfectant assigned	C	Control (No Disinfectant)
	W1	70% IPA (Wipe)
	W2	Calla® 1452 (Wipe)

Section of Sequence	Abbreviation	Details
to the test article for conditioning]	W3	Sani-Cide EX3 (Wipe)
	W4	PREempt™ RTU (Wipe)
C [This code denoted the specific disinfectant assigned to the test article for conditioning]	W5	Bactrokill + (Wipe)
	U1	222 nm -1 or 8 years (UV-C)
	U2	254 nm - 1 or 8 years (UV-C)
	U3	280 nm - 1 or 8 years (UV-C)
	U4	222 nm - 4 years (UV-C)
	U5	254 nm - 4 years (UV-C)
	U6	280 nm - 4 years (UV-C)
D [This code denoted the instance of test article within a specific configuration]	1	Test Article 1
	2	Test Article 2
	3	Test Article 3

9.1.2 Test matrix

DMA tests were conducted on two different plastics in accordance with ASTM D4065 (American Society of Testing and Materials, 2012). For each plastic type, three test articles were tested per disinfectant type as shown in Table 42 and Table 43.

Table 42. Matrix of test articles for DMA characteristic of plastic test articles conditioned with chemical disinfection

Plastic Type	**Test Standard**	**Chemical Disinfectant Type**					
		Control	**70% IPA**	**Calla® 1452**	**Sani-Cide EX3**	**PREempt™ RTU**	**Bactrokill +**
Lexan™ 9600	ASTM D4065 (American Society of Testing and Materials, 2012)	x3	x3	x3	x3	x3	x3
Poly II Acrylic		x3	x3	x3	x3	x3	x3

Table 43. Matrix of test articles DMA characteristics of plastic test articles conditioned with UV-C disinfection

Plastic Type	Test Standard	UV-C Disinfectant Type						
		Control	**222 nm Round 1 (4 years)**	**254 nm Round 1 (4 years)**	**280 nm Round 1 (4 years)**	**222 nm Round 2 (1 or 8 years)**	**254 nm Round 2 (1 or 8 years)**	**280 nm Round 2 (1 or 8 years)**
Lexan™ 9600	ASTM D4065	x3	x3	x3	x3	x3	x3	x3
Poly II Acrylic		x3	x3	x3	x3	x3	x3	x3

9.1.3 Test results

Post-test pictures of all test articles are located in Appendix E, along with plots comparing the onset storage modulus and peak of tangent delta. For all measured test criteria, a significant change is defined as an average change value of 15% or more compared to the average of the results from the three control specimens. For all conditioned plastic test articles, no significant change occurred to any of the measured test criteria for any of the disinfectant types. Variability in the data of ~5 °F for materials with a glass transition temperatures in this range is considered normal.

9.1.4 Summary of glass transition temperature testing

To better understand the effect that chemical disinfection had on plastics, dynamic mechanical analysis was performed after conditioning to determine if the polymer chemistry of the plastic test articles changed compared to the control specimens. The test articles were conditioned with the wiping and UV-C methods according to sections 4.2 and 4.3, and tested per section 9.1.2. No significant change was seen in the onset storage modulus or the peak of tangent delta measurements as a result of any of the disinfectant conditioning process. This result is not surprising for the test articles disinfected via wiping but is notable for the UV-C test articles. UV light can cause degradation of plastics by causing chain-scission or crosslinking depending on the specific polymer chemistry (Calamari, Wallington, & Flint, 1998). No change was noted in the onset modulus or the peak of tangent delta, implying that the polymer chemistry did not change as a result of UV-C disinfection. A summary of the test results can be found in Table 44 and Table 45, where the cells are highlighted different colors to represent the results.

Table 44. DMA results summary – wiping method

Material Type	**Disinfectant**				
	70% IPA	**Calla® 1452**	**Sani-Cide EX3**	**PREempt™ RTU**	**Bactrokill +**
Lexan™ 9600					
Poly II Acrylic					

Note. Blue indicates a change less than 15%.

Table 45. DMA results summary – UV-C method

Material Type	**Disinfectant**					
	222 nm	**254 nm**	**280 nm**	**222 nm**	**254 nm**	**280 nm**
Lexan™ 9600	4 years	4 years	4 years	8 years	1 year	8 years
Poly II Acrylic	4 years	4 years	4 years	8 years	1 year	1 year

Note. Blue indicates a change less than 15%.

9.2 Oleophobicity

Many flight deck displays have oleophobic coatings to prevent any impairment of the displays from the residual finger oils. To determine the effects that chemical and UV-C disinfection had on the oleophobicity of the display coating test articles (and thus any degradation of the coating), contact angle measurements were collected by NIAR ETL. The test articles evaluated for contact angle were conditioned using the wiping and UV-C methods as discussed in sections 4.2 and 4.3 respectively. The following sections discuss the details of this test. The same test articles were used for the evaluation of contact angle and light transmission and haze.

9.2.1 Specimen dimensions and nomenclature

Five of the six different types of the display coating test articles were manufactured with oleophobic coatings applied to the top side of the glass substrate test article. The nominal dimensions of the test articles are detailed in Table 46. Dimensions of test articles were measured and summarized in Appendix A.

Table 46. Contact angle and light transmission test article nominal dimensions

Length [L], in	3.00
Width [W], in	2.00

In order to facilitate test article identification and traceability, the following nomenclature was implemented [A-B-C-D]. Table 47 summarizes the specimen identification nomenclature used for the different plastic test articles

Table 47. Specimen ID nomenclature for contact angle and light transmission haze characterization

Section of Sequence	Abbreviation	Details
A [This code denoted the testing that the test article were subjected to]	L	Light Transmission and Haze
	C	Contact Angle
B [This code denoted the specific material the test article is made of]	C1	Antireflective/Antiglare/ Oleophobic Coating A
	C2	Oleophobic Coating B
	C3	Oleophobic Coating C
	C4	Oleophobic Coating D
	C5	Antireflective/Antiglare/ Conductive/Oleophobic Coating A
	C6	Antireflective/Conductive Coating
C [This code denoted the specific disinfectant assigned to the test article for conditioning]	C	Control (No disinfectant)
	W1	70% IPA
	W2	Calla® 1452
	W3	Sani-Cide EX3
	W4	PREempt™ RTU
	W5	Bactrokill +
	U1	222 nm (1 or 8 years)
	U2	254 nm (1 or 8 years)
	U3	280 nm (1 or 8 years)
	U4	222 nm (4 years)
	U5	254 nm (4 years)
	U6	280 nm (4 years)
D [This code denoted the instance of test article within a specific configuration]	1	Test Article 1
	2	Test Article 2
	3	Test Article 3

9.2.2 Test setup

Contact angle measurements were taken by NIAR ETL before light transmission and haze testing. Measurements were taken as soon as possible after the end of conditioning (which included the post conditioning weight and visual inspection). A Dino-Lite microscope was set up in accordance with Figure 19 where the test article was placed on the stage and the light was positioned as detailed in the figure. Using a micropipette, 20 ± 0.1 µL of one droplet of oil was placed on the surface of the test article as close to the edge as possible to allow the microscope to focus on both the curvature of the droplet and the top surface of the test article. Using the Dino-Lite™ software, an image of the droplet was taken. This process was repeated twice more on the same specimen. The three images were evaluated using the "Contact Angle" plugin of ImageJ. The contact measurements were collected by placing crosses on the image of the oil droplet as shown in Figure 20. The theta left and theta right measurements were then averaged across all three droplets and evaluated in comparison to the control specimens. The state of a specimen's oleophobicity is described in Equation 1:

$$f(x) = \begin{cases} 60° < \alpha & Super\ Oleophobic \\ 60° \leq \alpha \leq 90° & Oleophobic \\ 90° \leq \alpha & Oleophillic \end{cases} \qquad (1)$$

where α is the contact angle between the oil and the substrate.

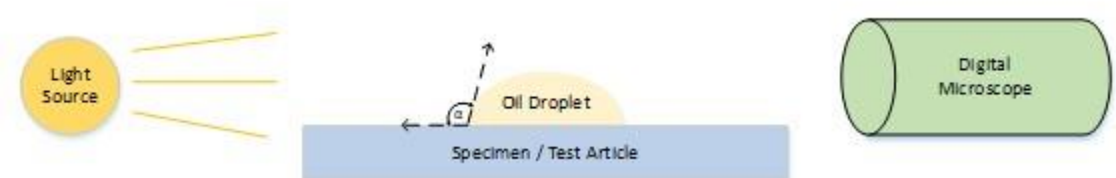

Figure 19. Schematic of Dino-Lite™ setup relative to test article

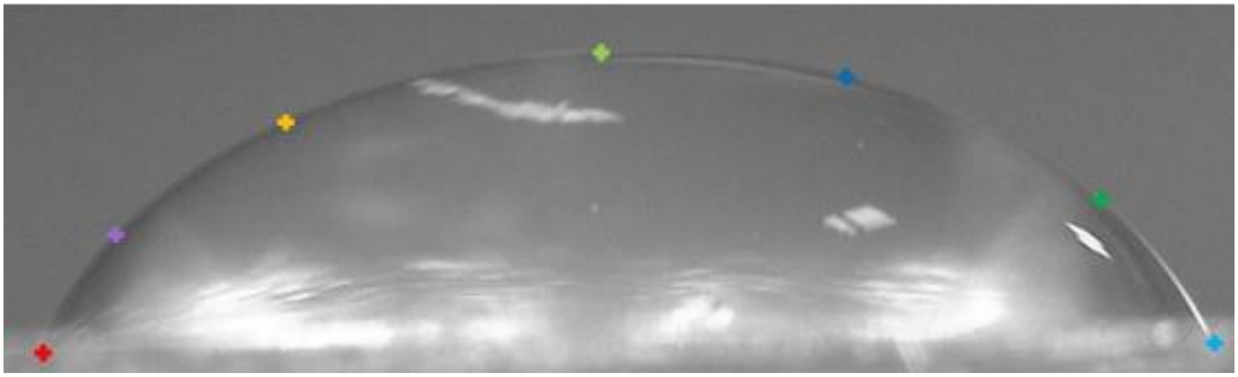

Figure 20. Location of all seven crosses needed for measurement

9.2.3 Test matrix

Contact angle measurements were collected on five different oleophobic glass coating test articles. For each coating type, three test articles were tested per disinfectant type as shown in Table 48 and Table 49.

Table 48. Matrix of oleophobicity test articles for coatings conditioned with chemical disinfection

Coating Type	**Chemical Disinfectant Type**					
	Control	**70% IPA**	**Calla® 1452**	**Sani-Cide EX3**	**Bactrokill +**	**PREempt ™ RTU**
Antireflective/ Antiglare/Oleophobic Coating A (C1)	x3	x3	x3	x3	x3	x3
Oleophobic Coating B (C2)	x3	x3	x3	x3	x3	x3
Oleophobic Coating C (C3)	x3	x3	x3	x3	x3	x3
Oleophobic Coating D (C4)	x3	x3	x3	x3	x3	x3
Antireflective/ Antiglare/Conductive/ Oleophobic Coating A (C5)	x3	x3	x3	x3	x3	x3

Table 49: Matrix of oleophobicity test articles for coatings conditioned with UV-C disinfection

Coating Type	**UV-C Disinfectant Type**						
	Control	**222 nm (4 years)**	**254 nm (4 years)**	**280 nm (4 years)**	**222 nm (1 or 8 years)**	**254 nm (1 or 8 years)**	**280 nm (1 or 8 years)**
Antireflective/Antiglare/ Oleophobic Coating A (C1)	x3	x3	x3	x3	x3	x3	x3
Oleophobic Coating B (C2)	x3	x3	x3	x3	x3	x3	x3
Oleophobic Coating C (C3)	x3	x3	x3	x3	x3	x3	x3
Oleophobic Coating D (C4)	x3	x3	x3	x3	x3	x3	x3
Antireflective/Antiglare/ Conductive/Oleophobic Coating A (C5)	x3	x3	x3	x3	x3	x3	x3

9.2.4 Test results

Post-test pictures of all test articles are located in Appendix F. Comparison of the average of all the droplets for each material and disinfectant type can be found in Table 50 and Table 51. As the average contact angle of all control specimens were all within 10° of the boundary between oleophobic and oleophillic, it is possible for the average angle value to change by less than 10° but have become oleophilic. Thus for all evaluated test articles, a significant change is defined as an average change in angle of at least 10° compared to the results from the control specimen, and/or a change in the state of oleophobic properties.

Table 50. Average of contact angle measurements – wiping method

Coating Type	**Disinfectant Type**	**Average(°)**	**Classification**
Antireflective/ Antiglare/ Oleophobic Coating A (C1)	Control	86.91	Oleophobic
	70% IPA	101.89	Oleophilic
	Calla® 1452	86.89	Oleophobic
	Sani-Cide EX3	92.49	Oleophilic

Coating Type	Disinfectant Type	Average(°)	Classification
	PREempt™ RTU	90.02	Oleophilic
	Bactrokill +	Unable to measure	Oleophilic
Oleophobic Coating B (C2)	Control	85.33	Oleophobic
	70% IPA	90.97	Oleophilic
	Calla® 1452	82.97	Oleophobic
	Sani-Cide EX3	91.29	Oleophilic
	PREempt™ RTU	83.9	Oleophobic
	Bactrokill +	83.43	Oleophobic
Oleophobic Coating C (C3)	Control	88.95	Oleophobic
	70% IPA	87.42	Oleophobic
	Calla® 1452	84.22	Oleophobic
	Sani-Cide EX3	86.75	Oleophobic
	PREempt™ RTU	84	Oleophobic
	Bactrokill +	83.9	Oleophobic
Oleophobic Coating D (C4)	Control	81.86	Oleophobic
	70% IPA	95.28	Oleophilic
	Calla® 1452	106.67	Oleophilic
	Sani-Cide EX3	101.91	Oleophilic
	PREempt™ RTU	133.36	Oleophilic
	Bactrokill +	Unable to measure	Oleophilic
Antireflective/ Antiglare/Conductive/ Oleophobic Coating A (C5)	Control	85.03	Oleophobic
	70% IPA	98.66	Oleophilic
	Calla® 1452	93.35	Oleophilic
	Sani-Cide EX3	93.08	Oleophilic
	PREempt™ RTU	80.41	Oleophobic
	Bactrokill +	104.71	Oleophilic

Note. Orange indicates a 10° or more change, or a change in oleophobicity classification. Blue indicates a change less than 10°, or no change in oleophobicity classification.

Table 51. Average of contact angle measurements – UV-C method

Coating Type	Disinfectant Type	Average(°)	Classification
Antireflective/ Antiglare/	Control	86.91	Oleophobic
	222 nm (8 years)	88.06	Oleophobic
	254 nm (1 year)	90.20	Oleophilic

Coating Type	Disinfectant Type	Average(°)	Classification
Oleophobic Coating A (C1)	280 nm (8 years)	87.50	Oleophobic
	222 nm (4 years)	86.90	Oleophobic
	254 nm (4 years)	81.81	Oleophobic
	280 nm (4 years)	94.20	Oleophobic
Oleophobic Coating B (C2)	Control	85.33	Oleophobic
	222 nm (1 year)	83.43	Oleophobic
	254 nm (8 years)	81.60	Oleophobic
	280 nm (8 years)	82.55	Oleophobic
	222 nm (4 years)	79.20	Oleophobic
	254 nm (4 years)	79.55	Oleophobic
	280 nm (4 years)	82.13	Oleophobic
Oleophobic Coating C (C3)	Control	88.95	Oleophobic
	222 nm (1 year)	81.96	Oleophobic
	254 nm (1 year)	81.61	Oleophobic
	280 nm (8 years)	81.16	Oleophobic
	222 nm (4 years)	79.41	Oleophobic
	254 nm (4 years)	79.83	Oleophobic
	280 nm (4 years)	80.66	Oleophobic
Oleophobic Coating D (C4)	Control	81.86	Oleophobic
	222 nm (1 year)	81.76	Oleophobic
Oleophobic Coating D (C4)	254 nm (1 year)	79.62	Oleophobic
	280 nm (1 year)	77.68	Oleophobic
	222 nm (4 years)	79.07	Oleophobic
	254 nm (4 years)	79.54	Oleophobic
	280 nm (4 years)	79.86	Oleophobic
Antireflective/ Antiglare/Conductive/ Oleophobic Coating A (C5)	Control	85.03	Oleophobic
	222 nm (8 years)	81.01	Oleophobic
	254 nm (8 years)	79.41	Oleophobic
	280 nm (8 years)	79.18	Oleophobic
	222 nm (4 years)	76.28	Oleophobic
	254 nm (4 years)	76.95	Oleophobic
	280 nm (4 years)	78.67	Oleophobic

Note. Orange indicates a 10° or more change, or a change in oleophobicity classification. Blue indicates a change less than 10°, or no change in oleophobicity classification.

9.2.5 Summary oleophobicity testing

To further study the effect of chemical and UV-C disinfection on the oleophobicity of glass coatings, test articles were conditioned per the wiping method described in section 4.2 and 4.3 and tested per section 9.2.2. The summary of the results of contact angle testing can be found in Table 52 and Table 53, where the cells are highlighted different colors to represent the results. For specific details of the test refer to section 9.2.4.

Table 52. Contact angle results summary – wiping method

Material Type	**Disinfectant**				
	70% IPA	**Calla® 1452**	**Sani-Cide EX3**	**PREempt™ RTU**	**Bactrokill +**
Antireflective/ Antiglare/ Oleophobic Coating A					
Oleophobic Coating B					
Oleophobic Coating C					
Oleophobic Coating D					
Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A					

Note. Orange indicates a 10° or more change in angle measurement and/or a change in classification to oleophilic. Blue indicates a change of less than 10° in angle measurement and remaining classified as oleophobic.

Table 53. Contact angle results summary – UV-C method

Material Type	Disinfectant					
	222 nm	**254 nm**	**280 nm**	**222 nm**	**254 nm**	**280 nm**
Antireflective/Antiglare/ Oleophobic Coating A	4 years	4 years	4 years	8 years	8 years	8 years
Oleophobic Coating B	4 years	4 years	4 years	1 year	8 years	8 years
Oleophobic Coating C	4 years	4 years	4 years	1 year	1 year	8 years
Oleophobic Coating D	4 years	4 years	4 years	1 year	1 year	1 year
Antireflective/Antiglare/ Conductive/Oleophobic Coating A	4 years	4 years	4 years	8 years	8 years	8 years

Note. Orange indicates a 10° or more change in angle measurement and/or a change in classification to oleophilic. Blue indicates a change of less than 10° in angle measurement and remaining classified as oleophobic.

9.3 Light transmission and haze

To determine the effects that chemical and UV-C disinfection had on the optical properties of coatings, light transmission, and haze testing was conducted by Element Materials Technology in Des Moines, Iowa after conditioning was complete. The test articles evaluated via light transmission and haze testing were conditioned using the wiping and UV-C methods as discussed in sections 4.2 and 4.3 respectively. The same test articles were used for the evaluation of contact angle and light transmission and haze, with contact angle measurements being taken before light transmission and haze testing. The definitions of the evaluated parameters are listed below. The following sections discuss the details of this test.

1. Total Luminous Transmittance: Ratio of the luminous flux transmitted by a body to the flux incident upon it.

2. Total Diffuse Transmittance: Fraction of diffusely transmitted visible light.

3. Percent Haze: The scattering of light by a specimen responsible for the reduction in contrast of objects viewed through it. The percent of transmitted light that is scattered so that its direction deviated more than a specified angle from the direction of the incident beam.

9.3.1 Specimen dimensions and nomenclature

Since the same specimens were used for both contact angle measurements and light transmission and haze testing, the test article will have the same dimensions and nomenclature as detailed in section 9.2.1.

9.3.2 Test setup

Once conditioning was complete, NIAR ETL ensured that the coating test articles were still clearly and properly labeled and any residual oil from the contact angle measurements were wiped off. The test articles were then tested by Element Materials Technology in accordance with ASTM D1003 section 7 (American Society for Testing and Materials, 2021). Once testing was complete, the test articles were sent back to NIAR ETL.

9.3.3 Test matrix

Light transmission and haze testing was completed for all six display coating types, with three test articles for each disinfectant type as summarized in Table 54 and Table 55.

Table 54. Matrix of test articles for light transmission and haze (per ASTM D1003 section 7) of coatings conditioned with chemical disinfection

Coating Type	**Chemical Disinfectant Type**					
	Control	**70% IPA**	**Calla® 1452**	**Sani-Cide EX3**	**Bactrokill +**	**PREempt™ RTU**
Antireflective/ Antiglare/ Oleophobic Coating A (C1)	x3	x3	x3	x3	x3	x3
Oleophobic Coating B (C2)	x3	x3	x3	x3	x3	x3
Oleophobic Coating C (C3)	x3	x3	x3	x3	x3	x3
Oleophobic Coating D (C4)	x3	x3	x3	x3	x3	x3
Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A (C5)	x3	x3	x3	x3	x3	x3

Coating Type	**Chemical Disinfectant Type**					
	Control	**70% IPA**	**Calla® 1452**	**Sani-Cide EX3**	**Bactrokill +**	**PREempt™ RTU**
Antireflective/ Conductive Coating (C6)	x3	x3	x3	x3	x3	x3

Table 55. Matrix of test articles for light transmittance and haze (per ASTM D1003 section 7) of coatings conditioned with UV-C disinfection

Coating Type	**UV-C Type**						
	Control	**222 nm (4 years)**	**254 nm (4 years)**	**280 nm (4 years)**	**222 nm (1 or 8 years)**	**254 nm (1 or 8 years)**	**280 nm (1 or 8 years)**
Antireflective/ Antiglare/ Oleophobic Coating A (C1)	x3	x3	x3	x3	x3	x3	x3
Oleophobic Coating B (C2)	x3	x3	x3	x3	x3	x3	x3
Oleophobic Coating C (C3)	x3	x3	x3	x3	x3	x3	x3
Oleophobic Coating D (C4)	x3	x3	x3	x3	x3	x3	x3
Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A (C5)	x3	x3	x3	x3	x3	x3	x3
Antireflective/ Conductive Coating (C6)	x3	x3	x3	x3	x3	x3	x3

9.3.4 Test results

Table 54 and Table 55 describe the test matrix used for the light transmission and haze testing. Post-test pictures of all test articles are located in Appendix F and test data is located in Appendix G. Comparison of the average measurements of the total luminous transmittance, diffuse luminous transmittance, and percent haze can be found in Table 56 and Table 57. For all measured test criteria, a significant change is defined as an average change value of 15% or more compared to the results from the control specimen.

Table 56. Light transmission and haze results – wiping method

Coating Type	Disinfectant Type	Average Percent Change from Control Value	
		Total Luminous Transmittance	Diffuse Luminous Transmittance
Antireflective/ Antiglare/ Oleophobic Coating A (C1)	Control	96.3	24.94
	70% IPA	0%	-4%
	Calla® 1452	-1%	100%
	Sani-Cide EX3	-2%	89%
	PREempt™ RTU	-2%	121%
	Bactrokill +	-2%	9%
Oleophobic Coating B (C2)	Control	93.3	0.76
	70% IPA	0%	-25%
	Calla® 1452	0%	1555%
	Sani-Cide EX3	-1%	2662%
	PREempt™ RTU	-1%	2771%
Oleophobic Coating B (C2)	Bactrokill +	0%	503%
Oleophobic Coating C (C3)	Control	93.2	0.51
	70% IPA	0%	-26%
	Calla® 1452	0%	1676%
	Sani-Cide EX3	-1%	4016%
	PREempt™ RTU	-2%	4937%
	Bactrokill +	0%	1072%
Oleophobic Coating D (C4)	Control	93.3	1.09
	70% IPA	0%	-31%
	Calla® 1452	0%	335%
	Sani-Cide EX3	-1%	3215%
	PREempt™ RTU	-1%	2926%
	Bactrokill +	0%	554%
Antireflective/ Antiglare/Conductive/ Oleophobic Coating A (C5)	Control	90.5	14.75
	70% IPA	-1%	-16%
	Calla® 1452	-2%	60%
	Sani-Cide EX3	-2%	125%
	PREempt™ RTU	-1%	142%
	Bactrokill +	-3%	0%

Coating Type	**Disinfectant Type**	**Average Percent Change from Control Value**	
		Total Luminous Transmittance	**Diffuse Luminous Transmittance**
Antireflective/ Conductive Coating (C6)	Control	94.5	0.35
	70% IPA	0%	112%
	Calla® 1452	-2%	2848%
	Sani-Cide EX3	-6%	11377%
	PREempt™ RTU	-5%	9259%
	Bactrokill +	-4%	3287%

Note. Orange indicates a 15% or more change. Blue indicates a change less than 15%.

Table 57. Test results light transmission and haze – UV-C method

Coating Type	**Disinfectant Type**	**Average Percent Change from Control Value**	
		Total Luminous Transmittance	**Diffuse Luminous Transmittance**
Antireflective/ Antiglare/ Oleophobic Coating A (C1)	Control	96.3	24.94
	222 nm (8 years)	0%	-3%
	254 nm (8 years)	0%	-3%
	280 nm (8 years)	0%	-2%
	222 nm (4 years)	0%	-3%
	254 nm (4 years)	0%	-4%
	280 nm (4 years)	0%	-4%
Oleophobic Coating B (C2)	Control	93.3	0.76
	222 nm (1 year)	0%	-15%
	254 nm (8 years)	0%	7%
	280 nm (8 years)	0%	13%
	222 nm (4 years)	-1%	17%
	254 nm (4 years)	-1%	15%
	280 nm (4 years)	-1%	15%
Oleophobic Coating C (C3)	Control	93.2	0.51
	222 nm (1 year)	0%	16%
	254 nm (1 year)	0%	38%
	280 nm (8 years)	0%	13%

Coating Type	Disinfectant Type	Average Percent Change from Control Value	
		Total Luminous Transmittance	Diffuse Luminous Transmittance
	222 nm (4 years)	0%	-9%
	254 nm (4 years)	-1%	8%
	280 nm (4 years)	-1%	-4%
Oleophobic Coating D (C4)	Control	93.3	1.09
	222 nm (1 year)	0%	33%
	254 nm (1 year)	0%	78%
	280 nm (1 year)	0%	26%
	222 nm (4 years)	-1%	-26%
	254 nm (4 years)	-1%	-21%
	280 nm (4 years)	0%	-31%
Antireflective/ Antiglare/Conductive/ Oleophobic Coating A (C5)	Control	90.5	14.75
	222 nm (8 years)	0%	-9%
	254 nm (8 years)	0%	6%
	280 nm (8 years)	0%	9%
	222 nm (4 years)	0%	-8%
	254 nm (4 years)	0%	-13%
	280 nm (4 years)	0%	-12%
Antireflective/ Conductive Coating (C6)	Control	94.5	0.35
	222 nm (1 year)	0%	-23%
	254 nm (8 years)	0%	-34%
	280 nm (8 years)	0%	-39%
	222 nm (4 years)	0%	-34%
	254 nm (4 years)	0%	-30%
	280 nm (4 years)	0%	5%

Note. Orange indicates a 15% or more change. Blue indicates a change less than 15%.

9.3.5 Summary of light transmission and haze testing

To further study how chemical and UV-C disinfectants effect the optical properties of glass display coatings, test articles were conditioned in accordance to section 4.2 and 4.3 and tested per section 9.3.2. Table 58 and Table 59 provide a summary of the test results, where the cells are highlighted different colors to represent the results. For further details of the test results refer to section 9.3.4.

Table 58. Light transmission & haze results summary – wiping method

Material Type	Disinfectant				
	70% IPA	**Calla® 1452**	**Sani-Cide EX3**	**PREempt™ RTU**	**Bactrokill +**
Antireflective / Antiglare/Oleophobic Coating A					
Oleophobic Coating B					
Oleophobic Coating C					
Oleophobic Coating D					
Antireflective/Antiglare/ Conductive/Oleophobic Coating A					
Antireflective/ Conductive Coating					

Note. Orange indicates a 15% or more change. Blue indicates a change less than 15%.

Table 59. Light transmission & haze results summary – UV-C method

Material Type	Disinfectant					
	222 nm	**254 nm**	**280 nm**	**222 nm**	**254 nm**	**280 nm**
Antireflective/ Antiglare/ Oleophobic Coating A	4 years	4 years	4 years	8 years	8 years	8 years
Oleophobic Coating B	4 years	4 years	4 years	1 year	8 years	8 years
Oleophobic Coating C	4 years	4 years	4 years	1 year	1 year	8 years
Oleophobic Coating D	4 years	4 years	4 years	1 year	1 year	1 year
Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A	4 years	4 years	4 years	8 years	8 years	8 years
Antireflective/Conductive Coating	4 years	4 years	4 years	1 year	1 year	8 years

Note. Orange indicates a 15% or more change. Blue indicates a change less than 15%.

10 Conclusions

In response to the COVID-19 pandemic, aircraft operators and manufacturers have been more frequently and thoroughly disinfecting the flight deck of aircraft. The goal of this study was to determine if more frequent disinfection of the materials found in a flight deck resulted in material degradation. The materials evaluated in this study were two types of plastic, six coatings, and four LRUs. For further information regarding the test article materials refer to section 2. Four different methods of disinfection were utilized for the conditioning process, which include spraying, fogging, wiping, and UV-C disinfection. For further information regarding the disinfection methods refer to section 4.

The material type determined the disinfection method and post-conditioning testing parameters evaluated. Regardless of material, all test articles were evaluated for changes in weight and visual appearance. The plastic test articles were evaluated using tensile testing, flammability testing, and DMA testing. The coating test articles first had contact angle measurements collected and then were tested for changes in light transmission and haze. The LRUs were evaluated for changes in functionality of the mechanical switches and functionality of the unit in a flight simulator. The plastic and coating test articles were conditioned using the wiping and UV-C disinfection methods. The LRUs were conditioned using the spraying, fogging, and wiping disinfection methods.

For all test data, with the exception of contact angle, a change in the test parameters greater than 15% in comparison with the control test articles was considered a significant change. Oleophobicity was considered to have a significant change if the contact angle changed by at least 10° compared to the results from the control specimen, and/or there was a change in the state of oleophobic properties.

10.1 Chemical disinfection

10.1.1 70% IPA

For LRUs wiped with 70% IPA there was no significant change in weight, visual inspection, or functional (mechanical switches) checks. LRUs wiped with 70% IPA failed the functional (simulator) check, but since a pre-conditioning check was not performed, it cannot be concluded that the conditioning was the cause of this failure.

For plastic test specimens wiped with 70% IPA, tensile tests on both P1 and P2 showed significant changes. Flammability tests on both P1 and P2 showed significant changes. No significant changes occurred with either plastic type for glass transition temperature, weight, or visual inspection.

For coating test specimens wiped with 70% IPA, light transmission & haze had a significant change for all coating types, except C1. Oleophobicity had a significant change for C1, C4, and C5 in both criteria. There was no significant change in the contact angle measurement for C2 or

C3, but C2 changed from being oleophobic to oleophilic. There were no significant changes in weight or visual inspection for any of the coating types.

10.1.2 Calla® 1452

For LRUs electrostatically sprayed with Calla® 1452, weight had no significant change. Visual inspection showed visible residue and localized discoloration and oxidation. Functional (mechanical switches) checks showed increased friction on the DUs knob. The LRU passed the functional (simulator) check, indicating that this conditioning method did not cause significant degradation.

For LRUs wiped with Calla® 1452, weight had no significant change. Visual inspection showed visible residue, localized discoloration and oxidation, and label damage. Functional (mechanical switches) checks showed increased friction on the toggle switch. The LRU passed the functional (simulator) check, indicating that this conditioning method did not cause degradation.

For plastic test specimens wiped with Calla® 1452, no significant changes for either plastic type occurred for tensile (ASTM D638). Flammability tests on both P1 and P2 showed significant changes.

There were no significant changes for either plastic type in weight and visual inspection, or in glass transition temperature.

There were no significant changes in weight or visual inspection for any of the coating types. The average contact angle had a significant change for C4. There was no significant change in contact angle for the other coating types. C5 changed from being oleophobic to oleophilic. For coating test specimens wiped with Calla® 1452, light transmission & haze had significant changes for all coating types.

10.1.3 Sani-Cide EX3

For LRUs wiped with Sani-Cide EX3, weight had no significant change. Visual inspection showed visible residue and localized discoloration. Functional (mechanical switches) checks showed increased friction on the toggle switch. The LRU failed the functional (simulator) check, but since a pre-conditioning check was not performed, it cannot be concluded that the conditioning was the cause of this failure.

For plastic test specimens wiped with Sani-Cide EX3, there were significant changes for both P1 and P2 for tensile (ASTM D638), flammability, and visual inspection. There was a change in visual inspection for all coating types. There were no significant changes for either plastic type for weight or glass transition temperature.

For coating test specimens wiped with Sani-Cide EX3, light transmission & haze had significant changes for all coating types. Oleophobicity had a significant change in both criteria for C4. There was no significant change in the average contact angle measurements for the other coating types. C2 and C5 changed from being oleophobic to oleophilic.

10.1.4 PREempt™ RTU

For LRUs wiped with PREempt™ RTU, there was no significant change in weight, visual inspection, or functional (mechanical switches) checks. The LRU failed the functional (simulator) check, but since a pre-conditioning check was not performed, it cannot be concluded that the conditioning was the cause of this failure.

For plastic specimens wiped with PREempt™ RTU, there was a significant change in tensile results for P2, but no significant change for P1. There were significant changes in flammability and visual inspection for both plastic types. There were no significant changes for either plastic type for glass transition temperature or weight.

For coating specimens wiped with PREempt™ RTU, light transmission & haze and visual inspection had significant changes for all coating types. Oleophobicity had a significant change for C4 in both criteria, but no significant change for the other coating types. There was no significant change in weight for any of the coating types.

10.1.5 Bactrokill +

For LRUs wiped with Bactrokill +, there was no significant change in weight, or functional (mechanical switches) checks. There was local discoloration and oxidation as a result of the visual inspection. The LRU failed the functional (simulator) check, but since a pre-conditioning check was not performed, it cannot be concluded that the conditioning was the cause of this failure.

For plastic test specimens wiped with Bactrokill +, there was a significant change in tensile results for P2, but no significant change for P1. There was a significant change in flammability results for P1, but no significant change for P2. No significant changes occurred for either plastic type for glass transition temperature, weight, or visual inspection.

For coating test specimens wiped with Bactrokill +, light transmission & haze had significant changes for C2, C3, C4, and C5, but no significant changes for C1 and C5. Oleophobicity had significant changes for C1, C4, and C5 in both criteria, but no significant changes for C2, or C3. There was no significant change in weight or visual inspection for any of the coating types.

10.1.6 Pheno D

For LRUs fogged with Pheno D, visual inspection showed visible residue. Weight and functional (mechanical switches) checks showed no significant change. The LRU failed the functional (simulator) check, but since a pre-conditioning check was not performed, it cannot be concluded that the conditioning was the cause of this failure.

10.2 UV-C disinfection

10.2.1 Round 1 (4 years)

In the first round of UV-C exposure subjected all of the test articles to an accelerated equivalent of four years of UV-C exposure at a rate of one cycle per day at 222 nm, 254 nm, and 280 nm.

10.2.1.1 222 nm

For plastic test specimens exposed to UV-C 222 nm for 4 years in Round 1, there was a significant change in tensile results for P2, but no significant change for P1. Flammability tests on both P1 and P2 showed significant changes. No significant changes occurred for either plastic type for glass transition temperature, weight, or visual inspection.

For coating test specimens exposed to UV-C 222 nm for 4 years in Round 1, light transmission & haze had a significant change for all coating types, except C1 and C5. There were no significant changes in oleophobicity, weight, or visual inspection for any of the coating types.

10.2.1.2 254 nm

For plastic test specimens exposed to UV-C 254 nm for 4 years in Round 1, there was a significant change in tensile results for P2, but no significant change for P1. Flammability tests on both P1 and P2 showed significant changes. There was a change for visual inspection of P2, which showed a yellow tint, but no change for P1. No significant changes occurred for either plastic type for glass transition temperature or weight.

For coating test specimens exposed to UV-C 254 nm for 4 years in Round 1, light transmission & haze had a significant change for C3, C4, and C6, but no significant change for except C1, C2, and C5. There were no significant changes in oleophobicity, weight, or visual inspection for any of the coating types.

10.2.1.3 280 nm

For plastic test specimens exposed to UV-C 280 nm for 4 years in Round 1, there was a significant change in tensile results for P2, but no significant change for P1. Flammability tests on both P1 and P2 showed significant changes. No significant changes occurred for either plastic type for glass transition temperature, weight, or visual inspection.

For coating test specimens exposed to UV-C 280 nm for 4 years in Round 1, light transmission & haze had a significant change for C4, but no significant changes for any of the other coating types. There were no significant changes in oleophobicity, weight, or visual inspection for any of the coating types.

10.2.2 Round 2 (1 or 8 years)

The second round of UV-C exposure was based on the results of the tests that took place after the first round of exposure. If no significant change was observed in any of the observable parameters (weight, visual, tensile, flammability, glass transition temperature, oleophobicity, or haziness) after a four year exposure, comparable but not-yet-conditioned test articles were exposed to UV-C disinfection for eight years in the second round. If a significant change was observed in any single one of the parameters after a four year exposure, all comparable but not-yet-conditioned test articles of that material type allocated for that specific wavelength were exposed to UV-C disinfection for one year in the second round. For a list of test articles that deviated from this procedure see section 5.

10.2.2.1 222 nm

No plastic test articles were conditioned for 1 year at 222 nm.

P1 and P2 were conditioned for 8 years at 222 nm. There was a significant change in tensile results for P2, but no significant change for P1. Flammability tests on the P1 had a significant change, but P2 had no significant change. No significant changes occurred for either plastic type for glass transition temperature, weight, or visual inspection.

C2, C3, C4, and C6 were conditioned for 1 year at 222 nm. Light transmission & haze had a significant change for C2, C4, and C6, but no significant changes for C4. None of the coatings had a significant change for oleophobicity, weight, or visual inspection.

C1 and C5 were conditioned for 8 years at 222 nm. There were no significant changes for light transmission and haze, oleophobicity, or weight for either C1 or C5. There were significant changes in the visual inspection of C1 and C5, with a noted foggy appearance of the test specimens

10.2.2.2 254 nm

P1 and P2 were conditioned for 1 year at 254 nm. There was a significant change in tensile results for P2, but no significant change for P1. Flammability tests on the P1 and P2 had no significant change. No significant changes occurred for either plastic type for glass transition temperature, weight, or visual inspection.

No plastic test articles were conditioned for 8 years at 254 nm.

C3, C4, and C6 were conditioned for 1 year at 254 nm. Light transmission & haze had a significant change for C4 and C6, but no significant changes for C3. None of the coatings had a significant change for oleophobicity, weight, or visual inspection.

C1, C2, and C5 were conditioned for 8 years at 254 nm. There were significant changes in the visual inspection of C1, with a noted foggy appearance of the test specimens. C2 and C5 had no change in visual inspection. C2 had a significant change in light transmission and haze, but C1 and C5 had no significant change. There were no significant changes for C1, C2, or C5 for weight or oleophobicity.

10.2.2.3 280 nm

P2 was conditioned for 1 year at 280 nm (with the exception of flammability, at 8 years, see section 5). There was a significant change in tensile test results. P2 had no significant change for flammability (8 years), glass transition temperature, weight, or visual inspection.

P1 was conditioned for 8 years at 280 nm (with the exception of flammability, at 1 year, see section 5). There was a change in visual inspection, with discoloration/ a yellow tint noted. There were no significant changes in tensile measurements. There was a significant change in flammability (1 year). There were no significant changes for weight, or glass transition temperature.

C4 was conditioned for 1 year at 280 nm. There was a significant change for light transmission and haze, but no significant change for oleophobicity, weight, or visual inspection.

C1, C2, C3, C5, and C6 were conditioned for 8 years at 280 nm. Light transmission & haze had a significant change for C2 and C6, but no significant changes for C1, C3, or C6. None of the coatings had a significant change for oleophobicity, visual inspection, or weight.

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A Test article dimensions

All dimensions in this appendix are given in inches.

Table 60. Tensile test article dimensions

Dimension	Nominal	Actual
Length Overall [LO], in	2.500	2.500 +0.02/-0.00
Length of Narrow Section [L], in	0.375 ± 0.003	0.375 +/-0.00
Width Overall [WO], in	0.375	0.375 +/- 0.005
Width Narrow Section [W], in	0.125 ± 0.001	0.125 +0.015/-0.005

Note. "Actual" dimension values reflect the span of the measurements from every tensile test article.

Table A- 1. Flammability test article dimensions

Dimension	Nominal	Actual
Length Overall (LO)	≤ 12	12
Width Overall (WO)	≤ 2	3

Note. "Actual" dimension values reflect the span of the measurements from every flammability test article.

Table A- 2. DMA test article dimensions

Dimension	Actual
Length Overall (LO)	3.00 ±0.00
Width Overall (WO)	3.00 +0.00/-0.01
Thickness (T1)	0.10 ±0.01

Note. "Actual" dimension values reflect the span of the measurements from every DMA test article.

Table A- 3. Contact angle & LT&H test article dimensions

Dimension	Actual
Length Overall (LO)	2.0 +0.2/-0.0
Width Overall (WO)	3.0 +0.1/-0.0

Note. "Actual" dimension values reflect the span of the measurements from every light transmission and haze test article.

B Test article weight

Table B- 1. Tensile test articles weight before and after conditioning – Lexan™ 9600

Test Article ID	Before Conditioning (g)	After Conditioning (g)
T-P1-C-1	1.38	N/A
T-P1-C-2	1.42	N/A
T-P1-C-3	1.42	N/A
T-P1-W1-1	1.38	1.37
T-P1-W1-2	1.39	1.38
T-P1-W1-3	1.4	1.39
T-P1-W2-1	1.42	1.42
T-P1-W2-2	1.43	1.42
T-P1-W2-3	1.37	1.37
T-P1-W3-1	1.4	1.4
T-P1-W3-2	1.42	1.42
T-P1-W3-3	1.41	1.41
T-P1-W4-1	1.42	1.42
T-P1-W4-2	1.39	1.39
T-P1-W4-3	1.42	1.42
T-P1-W5-1	1.43	1.42
T-P1-W5-2	1.38	1.37
T-P1-W5-3	1.4	1.42
T-P1-U1-1	1.41	1.41
T-P1-U1-2	1.38	1.37
T-P1-U1-3	1.39	1.37
T-P1-U2-1	1.42	1.42
T-P1-U2-2	1.4	1.4
T-P1-U2-3	1.41	1.4
T-P1-U3-1	1.43	1.43
T-P1-U3-2	1.42	1.44
T-P1-U3-3	1.43	1.42
T-P1-U4-1	1.38	1.37
T-P1-U4-2	1.41	1.4

Test Article ID	Before Conditioning (g)	After Conditioning (g)
T-P1-U4-3	1.42	1.41
T-P1-U5-1	1.42	1.42
T-P1-U5-2	1.41	1.4
T-P1-U5-3	1.39	1.38
T-P1-U6-1	1.41	1.4
T-P1-U6-2	1.43	1.42
T-P1-U6-3	1.41	1.41

Table B- 2. Tensile test article weights before and after conditioning – poly II acrylic

Test Article ID	Before Conditioning (g)	After Conditioning (g)
T-P2-C-1	1.38	N/A
T-P2-C-2	1.37	N/A
T-P2-C-3	1.36	N/A
T-P2-W1-1	1.38	1.37
T-P2-W1-2	1.38	1.35
T-P2-W1-3	1.38	1.37
T-P2-W2-1	1.38	1.37
T-P2-W2-2	1.37	1.36
T-P2-W2-3	1.37	1.37
T-P2-W3-1	1.38	1.38
T-P2-W3-2	1.37	1.37
T-P2-W3-3	1.38	1.38
T-P2-W4-1	1.38	1.39
T-P2-W4-2	1.36	1.36
T-P2-W4-3	1.39	1.39
T-P2-W5-1	1.39	1.37
T-P2-W5-2	1.37	1.38
T-P2-W5-3	1.4	1.36
T-P2-U1-1	1.38	1.37
T-P2-U1-2	1.36	1.34
T-P2-U1-3	1.38	1.36
T-P2-U2-1	1.4	1.36

Test Article ID	Before Conditioning (g)	After Conditioning (g)
T-P2-U2-2	1.38	1.36
T-P2-U2-3	1.38	1.36
T-P2-U3-1	1.39	1.37
T-P2-U3-2	1.38	1.36
T-P2-U3-3	1.37	1.35
T-P2-U4-1	1.43	1.36
T-P2-U4-2	1.37	1.36
T-P2-U4-3	1.39	1.38
T-P2-U5-1	1.37	1.36
T-P2-U5-2	1.39	1.37
T-P2-U5-3	1.4	1.38
T-P2-U6-1	1.37	1.35
T-P2-U6-2	1.38	1.36
T-P2-U6-3	1.4	1.39

Table B- 3. Flammability test articles weight – Lexan™ 9600

Test Article ID	Before Conditioning (g)	After Conditioning (g)
F-P1-C-1	68.18	N/A
F-P1-C-2	68.24	N/A
F-P1-C-3	68.34	N/A
F-P1-W1-1	68.12	68.08
F-P1-W1-2	68.19	68.02
F-P1-W1-3	68.15	67.76
F-P1-W2-1	67.78	67.64
F-P1-W2-2	68.41	68.42
F-P1-W2-3	68.61	68.29
F-P1-W3-1	68.95	69.16
F-P1-W3-2	69.46	69.6
F-P1-W3-3	68.16	68.29
F-P1-W4-1	69.96	68.89
F-P1-W4-2	68.75	68.72
F-P1-W4-3	69.14	69.15

Test Article ID	Before Conditioning (g)	After Conditioning (g)
F-P1-W5-1	66.52	66.54
F-P1-W5-2	67.64	67.65
F-P1-W5-3	68.23	68.97
F-P1-U1-1	67.78	67.64
F-P1-U1-2	67.94	67.82
F-P1-U1-3	67.87	67.92
F-P1-U2-1	67.06	66.96
F-P1-U2-2	68.3	68.1
F-P1-U2-3	66.73	66.62
F-P1-U3-1	67.23	67.11
F-P1-U3-2	66.87	66.86
F-P1-U3-3	68.16	68.1
F-P1-U4-1	68.67	68.3
F-P1-U4-2	67.96	67.96
F-P1-U4-3	68.41	68.42
F-P1-U5-1	68.57	68.26
F-P1-U5-2	69.05	68.33
F-P1-U5-3	68.36	67.6
F-P1-U6-1	68.67	68.42
F-P1-U6-2	68.43	68.4
F-P1-U6-3	68.45	68.38

Table B- 4. Flammability test article weight – poly II acrylic

Test Article ID	Before Conditioning (g)	After Conditioning (g)
F-P2-C-1	73.08	N/A
F-P2-C-2	76.57	N/A
F-P2-C-3	72.92	N/A
F-P2-W1-1	69.39	69.07
F-P2-W1-2	75.95	75.66
F-P2-W1-3	75.22	74.64
F-P2-W2-1	70.91	70.36
F-P2-W2-2	75.14	74.81

Test Article ID	Before Conditioning (g)	After Conditioning (g)
F-P2-W2-3	72.15	71.66
F-P2-W3-1	70.02	69.9
F-P2-W3-2	73.1	73.28
F-P2-W3-3	69.34	69.23
F-P2-W4-1	67.77	67.47
F-P2-W4-2	70.76	70.38
F-P2-W4-3	69.01	68.6
F-P2-W5-1	73.86	73.58
F-P2-W5-2	68.52	68.13
F-P2-W5-3	68.07	67.64
F-P2-U1-1	68.78	68.01
F-P2-U1-2	76.34	75.91
F-P2-U1-3	70.68	70.33
F-P2-U2-1	70.64	76.16
F-P2-U2-2	71.28	70.87
F-P2-U2-3	76.32	77.36
F-P2-U3-1	74.51	74.17
F-P2-U3-2	77.06	76.65
F-P2-U3-3	77.27	72.44
F-P2-U4-1	70.16	69.93
F-P2-U4-2	69.55	69.1
F-P2-U4-3	72.91	72.4
F-P2-U5-1	71.88	71.5
F-P2-U5-2	70.65	70.19
F-P2-U5-3	71.35	70.75
F-P2-U6-1	70.28	71.05
F-P2-U6-2	71.58	71.39
F-P2-U6-3	71.9	71.81

Table B- 5. DMA test article weight – Lexan™ 9600

Test Article ID	Before Conditioning (g)	After Conditioning (g)
D-P1-C-1	16.71	N/A
D-P1-C-2	16.69	N/A
D-P1-C-3	16.76	N/A
D-P1-W1-1	16.75	16.73
D-P1-W1-2	16.75	16.73
D-P1-W1-3	16.77	16.75
D-P1-W2-1	16.77	16.76
D-P1-W2-2	17.03	17.04
D-P1-W2-3	17.19	17.2
D-P1-W3-1	17.1	17.13
D-P1-W3-2	17.18	17.21
D-P1-W3-3	17.25	17.28
D-P1-W4-1	17.17	17.19
D-P1-W4-2	17.19	17.22
D-P1-W4-3	17.07	17.12
D-P1-W5-1	17.17	17.17
D-P1-W5-2	17.11	17.12
D-P1-W5-3	17.1	17.11
D-P1-U1-1	17.18	17.173
D-P1-U1-2	17.14	17.12
D-P1-U1-3	17.16	17.15
D-P1-U2-1	17.19	17.18
D-P1-U2-2	17.1	17.09
D-P1-U2-3	17.05	17.03
D-P1-U3-1	17.17	17.16
D-P1-U3-2	17.24	17.22
D-P1-U3-3	17.19	17.17
D-P1-U4-1	17.06	17.06
D-P1-U4-2	17.05	17.05
D-P1-U4-3	17.13	17.12
D-P1-U5-1	17.15	17.14

Test Article ID	Before Conditioning (g)	After Conditioning (g)
D-P1-U5-2	17.16	17.15
D-P1-U5-3	17.1	17.09
D-P1-U6-1	17.23	17.22
D-P1-U6-2	17.27	17.26
D-P1-U6-3	17.23	17.22

Table B- 6. DMA test article weight – poly II acrylic

Test Article ID	Before Conditioning (g)	After Conditioning (g)
D-P2-C-1	18.52	N/A
D-P2-C-2	17.61	N/A
D-P2-C-3	17.83	N/A
D-P2-W1-1	18.07	18.03
D-P2-W1-2	17.75	17.71
D-P2-W1-3	18.23	18.24
D-P2-W2-1	18.7	18.73
D-P2-W2-2	17.49	17.48
D-P2-W2-3	17.41	17.42
D-P2-W3-1	17.65	17.69
D-P2-W3-2	17.49	17.54
D-P2-W3-3	17.41	17.45
D-P2-W4-1	17.55	17.59
D-P2-W4-2	17.56	17.6
D-P2-W4-3	17.53	17.54
D-P2-W5-1	17.63	17.64
D-P2-W5-2	17.11	17.12
D-P2-W5-3	17.58	17.52
D-P2-U1-1	17.58	17.52
D-P2-U1-2	17.18	17.13
D-P2-U1-3	17.61	17.55
D-P2-U2-1	17.69	17.64
D-P2-U2-2	17.5	17.44
D-P2-U2-3	17.47	17.42

Test Article ID	Before Conditioning (g)	After Conditioning (g)
D-P2-U3-1	17.15	17.09
D-P2-U3-2	17.18	17.13
D-P2-U3-3	17.32	17.29
D-P2-U4-1	17.25	17.22
D-P2-U4-2	17.45	17.43
D-P2-U4-3	17.38	17.35
D-P2-U5-1	17.3	17.27
D-P2-U5-2	17.25	17.22
D-P2-U5-3	17.25	17.22
D-P2-U6-1	17.29	17.27
D-P2-U6-2	17.44	17.4
D-P2-U6-3	17.49	17.46

Table B- 7. Contact angle & LT&H test article weight - antireflective/antiglare/oleophobic coating A

Test Article ID	Before Conditioning (g)	After Conditioning (g)
LC-C1-C-1	2.81	N/A
LC-C1-W1-1	2.93	2.93
LC-C1-W1-2	2.86	2.86
LC-C1-W1-3	2.83	2.84
LC-C1-W2-1	2.95	2.96
LC-C1-W2-2	2.84	2.85
LC-C1-W2-3	2.89	2.9
LC-C1-W3-1	2.89	2.9
LC-C1-W3-2	2.89	2.9
LC-C1-W3-3	2.89	2.91
LC-C1-W4-1	2.93	2.94
LC-C1-W4-2	2.93	2.94
LC-C1-W4-3	2.9	2.91
LC-C1-W5-1	2.93	2.93
LC-C1-W5-2	2.93	2.93
LC-C1-W5-3	2.92	2.93

Test Article ID	Before Conditioning (g)	After Conditioning (g)
LC-C1-U1-1	2.92	2.92
LC-C1-U1-2	2.89	2.89
LC-C1-U1-3	2.93	2.93
LC-C1-U2-1	2.89	2.88
LC-C1-U2-2	2.89	2.88
LC-C1-U2-3	2.92	2.92
LC-C1-U3-1	2.89	2.89
LC-C1-U3-2	2.93	2.93
LC-C1-U3-3	2.95	2.95
LC-C1-U4-1	2.95	2.96
LC-C1-U4-2	2.95	2.96
LC-C1-U4-3	2.95	2.95
LC-C1-U5-1	2.95	2.95
LC-C1-U5-2	2.91	2.89
LC-C1-U5-3	2.94	2.94
LC-C1-U6-1	2.88	2.89
LC-C1-U6-2	2.86	2.87
LC-C1-U6-3	2.81	2.82

Table B- 8. Contact angle & LT&H test article weight – oleophobic coating B

Test Article ID	Before Conditioning (g)	After Conditioning (g)
LC-C2-C-1	10.44	N/A
LC-C2-W1-1	10.48	10.48
LC-C2-W1-2	10.57	10.57
LC-C2-W1-3	10.52	10.52
LC-C2-W2-1	10.44	10.45
LC-C2-W2-2	10.48	10.49
LC-C2-W2-3	10.43	10.43
LC-C2-W3-1	10.45	10.46
LC-C2-W3-2	10.52	10.52
LC-C2-W3-3	10.43	10.43
LC-C2-W4-1	10.48	10.49

Test Article ID	Before Conditioning (g)	After Conditioning (g)
LC-C2-W4-2	10.47	10.48
LC-C2-W4-3	10.57	10.58
LC-C2-W5-1	10.51	10.52
LC-C2-W5-2	10.43	10.43
LC-C2-W5-3	10.46	10.46
LC-C2-U1-1	10.45	10.45
LC-C2-U1-2	10.51	10.51
LC-C2-U1-3	10.48	10.48
LC-C2-U2-1	10.45	10.45
LC-C2-U2-2	10.5	10.5
LC-C2-U2-3	10.55	10.56
LC-C2-U3-1	10.6	10.6
LC-C2-U3-2	10.53	10.53
LC-C2-U3-3	10.46	10.46
LC-C2-U4-1	10.5	10.5
LC-C2-U4-2	10.44	10.44
LC-C2-U4-3	10.46	10.46
LC-C2-U5-1	10.48	10.48
LC-C2-U5-2	10.5	10.51
LC-C2-U5-3	10.54	10.54
LC-C2-U6-1	10.54	10.54
LC-C2-U6-2	10.6	10.6
LC-C2-U6-3	10.48	10.49

Table B- 9. Contact angle & LT&H test article weight – oleophobic coating C

Test Article ID	Before Conditioning (g)	After Conditioning (g)
LC-C3-C-1	10.46	N/A
LC-C3-W1-1	10.51	10.51
LC-C3-W1-2	10.46	10.46
LC-C3-W1-3	10.49	10.49
LC-C3-W2-1	10.49	10.5
LC-C3-W2-2	10.48	10.49
LC-C3-W2-3	10.59	10.6

Test Article ID	Before Conditioning (g)	After Conditioning (g)
LC-C3-W3-1	10.59	10.59
LC-C3-W3-2	10.46	10.46
LC-C3-W3-3	10.45	10.46
LC-C3-W4-1	10.46	10.47
LC-C3-W4-2	10.59	10.6
LC-C3-W4-3	10.51	10.52
LC-C3-W5-1	10.5	10.51
LC-C3-W5-2	10.55	10.56
LC-C3-W5-3	10.56	10.56
LC-C3-U1-1	10.53	10.53
LC-C3-U1-2	10.53	10.53
LC-C3-U1-3	10.51	10.51
LC-C3-U2-1	10.56	10.56
LC-C3-U2-2	10.55	10.55
LC-C3-U2-3	10.49	10.49
LC-C3-U3-1	10.54	10.54
LC-C3-U3-2	10.53	10.53
LC-C3-U3-3	10.44	10.44
LC-C3-U4-1	10.45	10.45
LC-C3-U4-2	10.41	10.42
LC-C3-U4-3	10.46	10.6
LC-C3-U5-1	10.47	10.47
LC-C3-U5-2	10.46	10.46
LC-C3-U5-3	10.4	10.4
LC-C3-U6-1	10.46	10.46
LC-C3-U6-2	10.5	10.5
LC-C3-U6-3	10.61	10.61

Table B- 10. Contact angle & LT&H test article weight – oleophobic coating D

Test Article ID	Before Conditioning (g)	After Conditioning (g)
LC-C4-C-1	10.64	N/A
LC-C4-W1-1	10.62	10.61

Test Article ID	Before Conditioning (g)	After Conditioning (g)
LC-C4-W1-2	10.6	10.6
LC-C4-W1-3	10.6	10.6
LC-C4-W2-1	10.57	10.58
LC-C4-W2-2	10.58	10.59
LC-C4-W2-3	10.56	10.56
LC-C4-W3-1	10.56	10.57
LC-C4-W3-2	10.56	10.57
LC-C4-W3-3	10.63	10.64
LC-C4-W4-1	10.59	10.6
LC-C4-W4-2	10.56	10.57
LC-C4-W4-3	10.56	10.57
LC-C4-W5-1	10.61	10.61
LC-C4-W5-2	10.57	10.58
LC-C4-W5-3	10.62	10.62
LC-C4-U1-1	10.58	10.58
LC-C4-U1-2	10.55	10.55
LC-C4-U1-3	10.61	10.61
LC-C4-U2-1	10.63	10.63
LC-C4-U2-2	10.55	10.56
LC-C4-U2-3	10.55	10.55
LC-C4-U3-1	10.58	10.58
LC-C4-U3-2	10.6	10.59
LC-C4-U3-3	10.61	10.61
LC-C4-U4-1	10.57	10.57
LC-C4-U4-2	10.61	10.62
LC-C4-U4-3	10.6	10.61
LC-C4-U5-1	10.56	10.56
LC-C4-U5-2	10.62	10.63
LC-C4-U5-3	10.59	10.6
LC-C4-U6-1	10.55	10.55
LC-C4-U6-2	10.55	10.55
LC-C4-U6-3	10.56	10.56

Table B- 11. Contact angle & LT&H test article weight - antireflective/antiglare/conductive/ oleophobic coating A

Test Article ID	Before Conditioning (g)	After Conditioning (g)
LC-C5-C-1	2.55	N/A
LC-C5-W1-1	2.55	2.55
LC-C5-W1-2	2.54	2.55
LC-C5-W1-3	2.54	2.55
LC-C5-W2-1	2.64	2.65
LC-C5-W2-2	2.63	2.65
LC-C5-W2-3	2.66	2.59
LC-C5-W3-1	2.66	2.68
LC-C5-W3-2	2.65	2.68
LC-C5-W3-3	2.64	2.67
LC-C5-W4-1	2.63	2.35
LC-C5-W4-2	2.63	2.64
LC-C5-W4-3	2.63	2.65
LC-C5-W5-1	2.63	2.64
LC-C5-W5-2	2.64	2.65
LC-C5-W5-3	2.55	2.56
LC-C5-U1-1	2.54	2.49
LC-C5-U1-2	2.55	2.55
LC-C5-U1-3	2.54	2.55
LC-C5-U2-1	2.52	2.53
LC-C5-U2-2	2.52	2.52
LC-C5-U2-3	2.53	2.54
LC-C5-U3-1	2.53	2.53
LC-C5-U3-2	2.55	2.56
LC-C5-U3-3	2.55	2.56
LC-C5-U4-1	2.53	2.54
LC-C5-U4-2	2.53	2.54
LC-C5-U4-3	2.53	2.54
LC-C5-U5-1	2.53	2.54
LC-C5-U5-2	2.64	2.65
LC-C5-U5-3	2.64	2.65

Test Article ID	Before Conditioning (g)	After Conditioning (g)
LC-C5-U6-1	2.63	2.63
LC-C5-U6-2	2.63	2.63
LC-C5-U6-3	2.55	2.56

Table B- 12. Light transmission & haze test article weight - antireflective/conductive coating

Test Article ID	Before Conditioning (g)	After Conditioning (g)
L-C6-C-1	10.16	N/A
L-C6-W1-1	10.12	10.12
L-C6-W1-2	10.11	10.11
L-C6-W1-3	10.13	10.13
L-C6-W2-1	10.13	10.14
L-C6-W2-2	10.16	10.16
L-C6-W2-3	10.15	10.14
L-C6-W3-1	10.17	10.18
L-C6-W3-2	10.15	10.17
L-C6-W3-3	10.12	10.14
L-C6-W4-1	10.15	10.16
L-C6-W4-2	10.15	10.16
L-C6-W4-3	10.14	10.15
L-C6-W5-1	10.13	10.13
L-C6-W5-2	10.14	10.15
L-C6-W5-3	10.16	10.16
L-C6-U1-1	10.15	10.14
L-C6-U1-2	10.13	10.13
L-C6-U1-3	10.14	10.14
L-C6-U2-1	10.13	10.13
L-C6-U2-2	10.14	10.14
L-C6-U2-3	10.15	10.14
L-C6-U3-1	10.14	10.14
L-C6-U3-2	10.15	10.15
L-C6-U3-3	10.15	10.15
L-C6-U4-1	10.15	10.15

Test Article ID	Before Conditioning (g)	After Conditioning (g)
L-C6-U4-2	10.14	10.14
L-C6-U4-3	10.14	10.14
L-C6-U5-1	10.12	10.12
L-C6-U5-2	10.15	10.15
L-C6-U5-3	10.16	10.16
L-C6-U6-1	10.15	10.15
L-C6-U6-2	10.17	10.17
L-C6-U6-3	10.14	10.14

C Tensile test data and photos

Table C- 1. Tensile test data – Lexan™ 9600

Test Article ID	Yield Stress (psi)	Yield strain (%)	Modulus (ksi)	Tensile Strength (psi)	Failure strain (%)
T-P1-C-1	9510.5	6.09	346.5	8155.6	81.22
T-P1-C-2	9576.2	6.14	351.2	9210.9	100.04
T-P1-C-3	9406.4	6.39	335.7	9197.4	101.43
T-P1-W1-1	9294.9	6.2	326.5	9949.2	118.85
T-P1-W1-2	9018.5	6.23	326.2	9445.4	109.47
T-P1-W1-3	9212.8	5.89	325.3	9810.8	117.00
T-P1-W2-1	9432.07	6.54	333.94	10236.47	113.85
T-P1-W2-2	9437.69	6.48	333.81	9580.81	108.32
T-P1-W2-3	9434.72	5.95	351.90	9049.04	97.51
T-P1-W3-1	9435.97	6.52	331.27	10038.11	116.96
T-P1-W3-2	9467.99	6.68	347.02	10190.85	120.35
T-P1-W3-3	9541.31	6.60	338.48	10510.15	124.58
T-P1-W4-1	9570.8	6.37	360.3	10107.9	107.5
T-P1-W4-2	9278.0	6.48	337.9	9785.4	107.3
T-P1-W4-3	9325.0	6.02	342.3	9346.9	104.6
T-P1-W5-1	9087.6	6.58	335.6	8745	94.89
T-P1-W5-2	9335.9	6.5	344.9	9418.2	106.71
T-P1-W5-3	9342.9	6.16	346.7	9722.9	113.07
T-P1-U1-1	9166.0	6.61	332.2	8847.5	101.70
T-P1-U1-2	9669.7	6.71	358.3	8976.5	91.01
T-P1-U1-3	9540.0	6.47	342.2	8337.9	83.49
T-P1-U2-1	8986.8	6.33	328.7	8764.1	102.62
T-P1-U2-2	9679.7	6.13	346.5	8684.7	90.03
T-P1-U2-3	9494.9	6.34	347.8	8688.3	89.38
T-P1-U3-1	9169.9	6.54	341.4	8880.8	97.38
T-P1-U3-2	9089.1	6.35	326.8	7791.2	80.95
T-P1-U3-3	9272.2	6.40	336.0	8602.2	94.36
T-P1-U4-1	9421.1	6.33	329.4	9481.3	105.75

Test Article ID	Yield Stress (psi)	Yield strain (%)	Modulus (ksi)	Tensile Strength (psi)	Failure strain (%)
T-P1-U4-2	9489.9	6.31	338.8	8465.7	89.58
T-P1-U4-3	9303.1	6.24	334.5	9040.5	97.03
T-P1-U5-1	9317.6	6.43	344.0	8499.4	94.27
T-P1-U5-2	9119.1	6.04	336.6	8173.6	89.44
T-P1-U5-3	9582.6	5.96	351.6	9666.8	113.56
T-P1-U6-1	9061.6	6.10	333.5	8827.9	97.96
T-P1-U6-2	9161.4	6.33	335.2	8695.4	98.04
T-P1-U6-3	9263.1	6.79	342.8	9210.7	102.70

Table C- 2. Tensile test data – poly II acrylic

Test Article ID	Yield Stress (psi)	Yield strain (%)	Modulus (ksi)	Tensile Strength (psi)	Failure strain (%)
T-P2-C-1	11025.42	6.16	440.83	9237.42	17.10
T-P2-C-2	11127.87	6.96	429.37	10517.28	11.10
T-P2-C-3	10985.10	6.77	434.06	10860.95	7.81
T-P2-W1-1	11101.60	5.66	446.40	10799.55	8.41
T-P2-W1-2	11071.00	6.34	434.10	10649.22	8.41
T-P2-W1-3	10968.80	6.37	433.90	10669.29	9.01
T-P2-W2-1	10795.31	6.11	437.46	9735.06	12.76
T-P2-W2-2	11029.83	6.29	435.89	10818.75	8.27
T-P2-W2-3	10888.94	7.02	426.48	8560.97	19.33
T-P2-W3-1	10871.98	6.76	454.24	9767.42	12.88
T-P2-W3-2	10535.60	6.50	434.84	7226.36	33.98
T-P2-W3-3	10280.67	7.05	394.35	8782.05	17.15
T-P2-W4-1	11086.7	6.53	454.2	7628.8	27.68
T-P2-W4-2	11087.8	6.56	432.5	9565.4	15.8
T-P2-W4-3	10928.9	6.7	426.5	10070.7	11.86
T-P2-W5-1	10795.9	5.94	423.1	10795.9	6.09
T-P2-W5-2	10927.45	6.2	435.8	10542.6	9.5
T-P2-W5-3	11043.2	5.67	435.2	10846.6	8.39

Test Article ID	Yield Stress (psi)	Yield strain (%)	Modulus (ksi)	Tensile Strength (psi)	Failure strain (%)
T-P2-U1-1	11334.34	4.0	475.4	11334.34	4.01
T-P2-U1-2	10881.35	4.1	525.7	10881.35	4.09
T-P2-U1-3	11187.67	4.2	574.4	11187.67	4.23
T-P2-U2-1	11882.72	6.5	476.5	11590.68	9.05
T-P2-U2-2	11780.90	6.7	510.1	11698.02	7.81
T-P2-U2-3	11845.86	6.6	543.3	11660.68	8.53
T-P2-U3-1	11475.68	5.7	512.5	11473.90	5.75
T-P2-U3-2	11383.14	6.5	484.3	11357.79	6.63
T-P2-U3-3	11750.95	6.2	521.6	11691.28	7.32
T-P2-U4-1	10505.3	3.98	438.4	N/A	N/A
T-P2-U4-2	10691.5	3.99	438.9	N/A	N/A
T-P2-U4-3	10866.5	4.35	435.5	N/A	N/A
T-P2-U5-1	5480	1.29	451.9	N/A	N/A
T-P2-U5-2	5438.5	1.25	479.7	N/A	N/A
T-P2-U5-3	5465.4	1.28	530.1	N/A	N/A
T-P2-U6-1	11392.9	6.23	467.0	11344.7	6.54
T-P2-U6-2	11279.4	5.53	525.9	11259.1	5.56
T-P2-U6-3	11301.4	5.85	471.6	10491.4	10.97

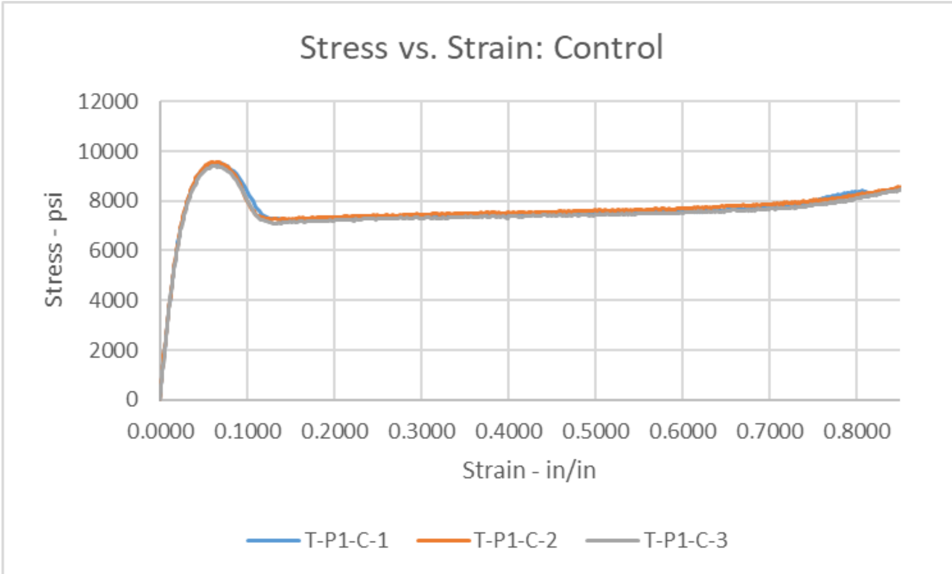


Figure C- 1. Longitudinal stress vs. strain – Lexan™ 9600 – control

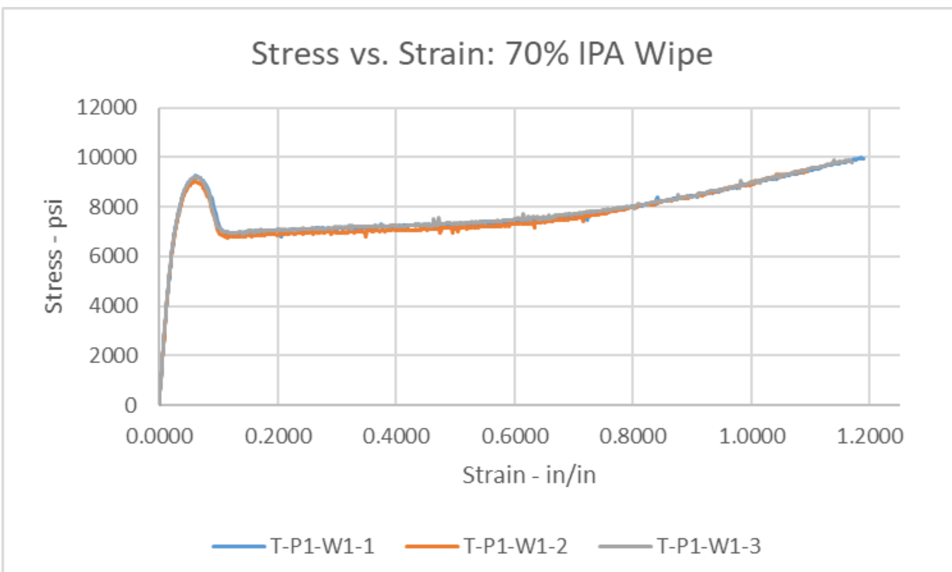


Figure C- 2. Longitudinal stress vs. strain – Lexan™ 9600 – 70% IPA

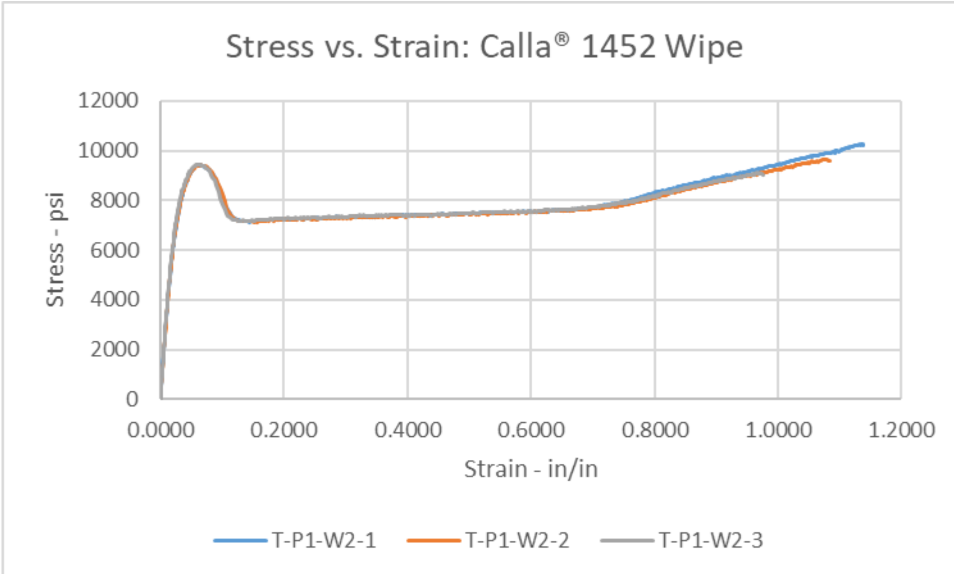


Figure C- 3. Longitudinal stress vs. strain – Lexan™ 9600 – Calla® 1452

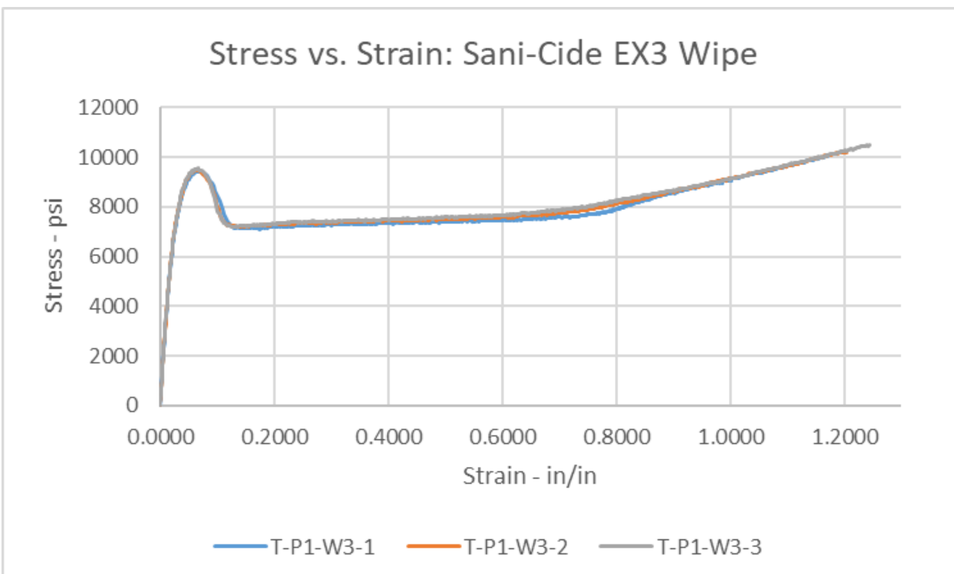


Figure C- 4. Longitudinal stress vs. strain – Lexan™ 9600 – Sani-Cide EX3

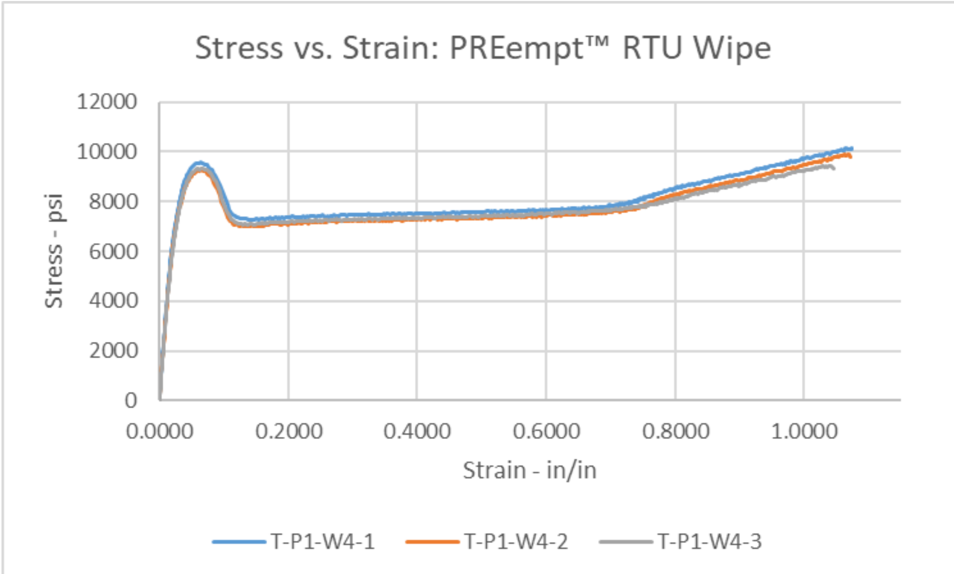


Figure C- 5. Longitudinal stress vs. strain – Lexan™ 9600 – PREempt™ RTU

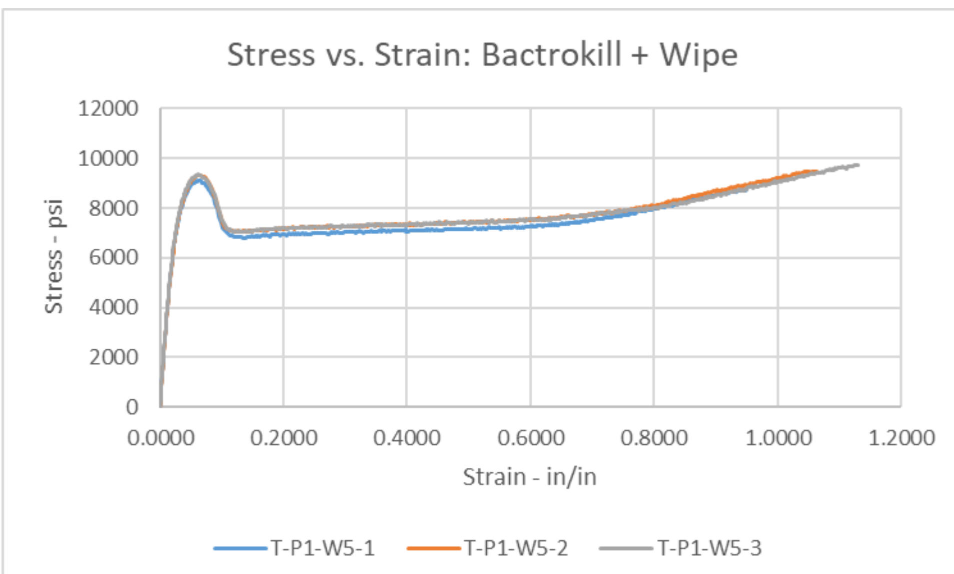


Figure C- 6. Longitudinal stress vs. strain – Lexan™ 9600 – Bactrokill +

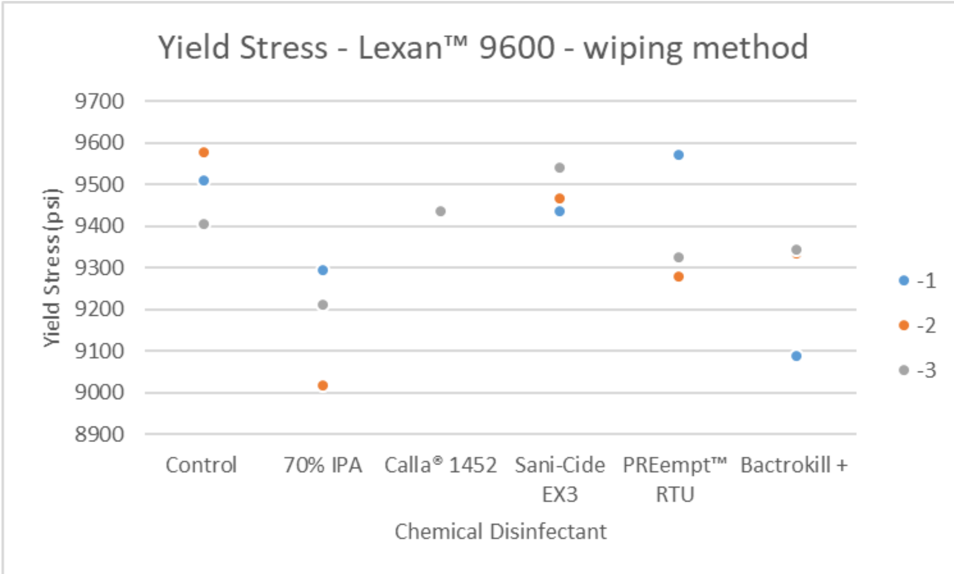


Figure C- 7. Yield stress – Lexan™ 9600 – wiping method

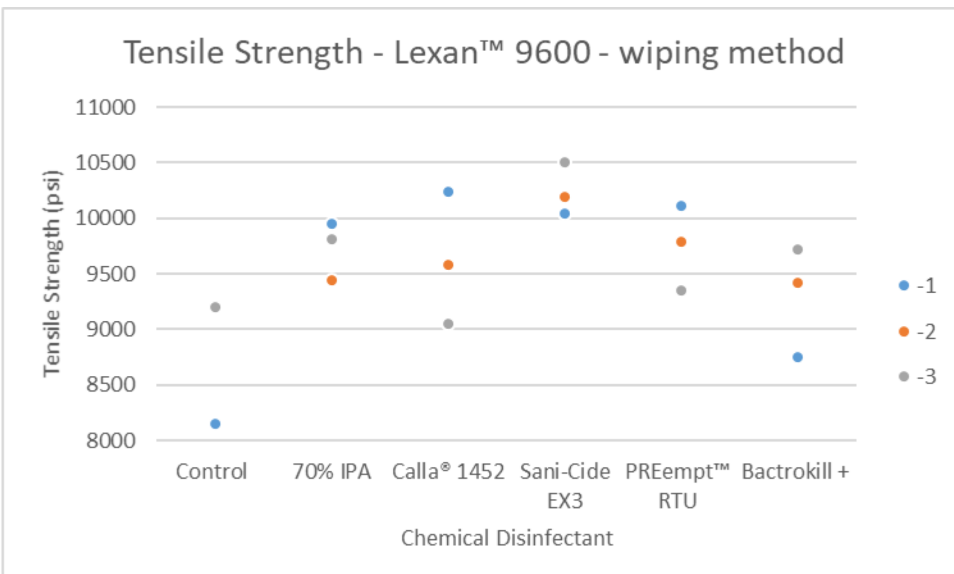


Figure C- 8. Tensile strength – Lexan™ 9600 – wiping method

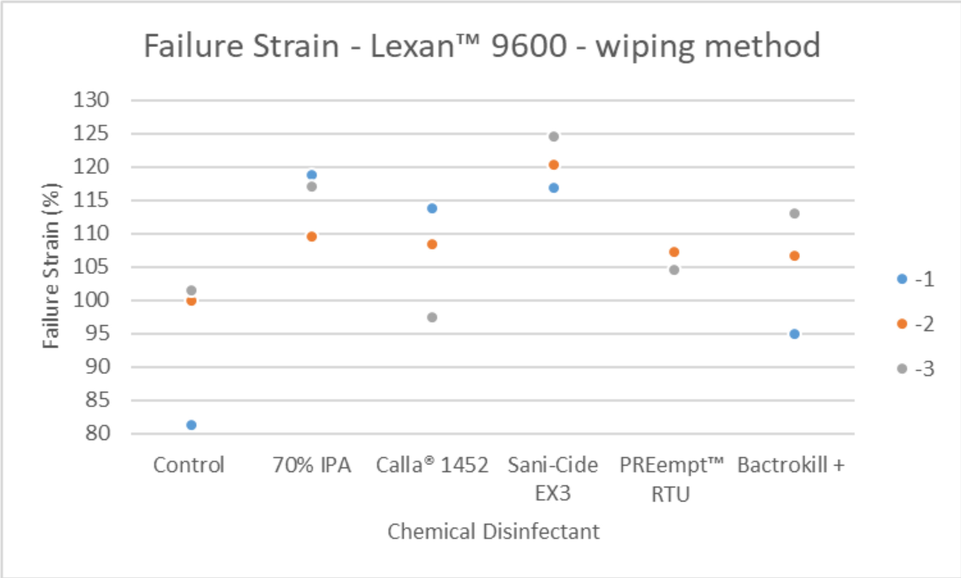


Figure C- 9. Failure strain – Lexan™ 9600 – wiping method

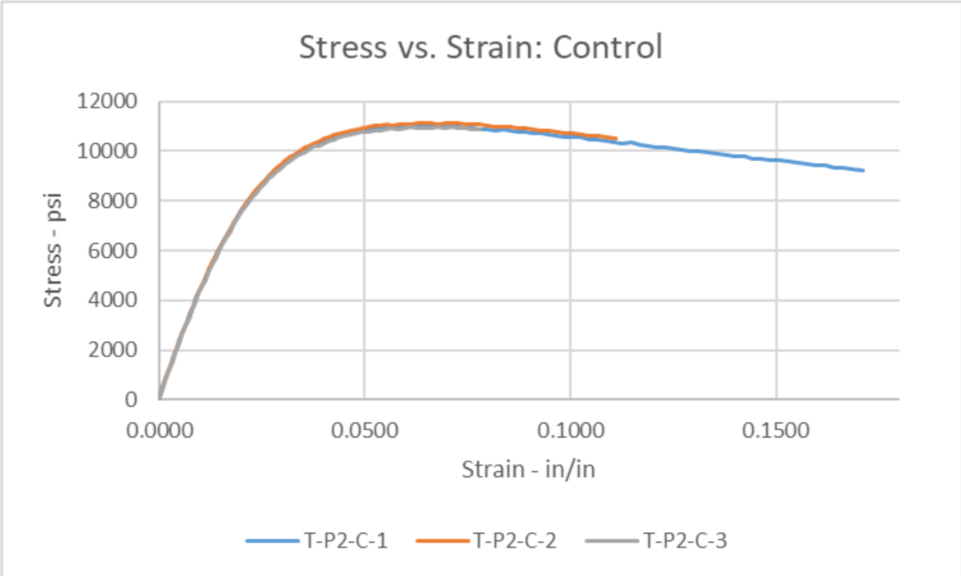


Figure C- 10. Longitudinal stress vs. strain – poly II acrylic – control

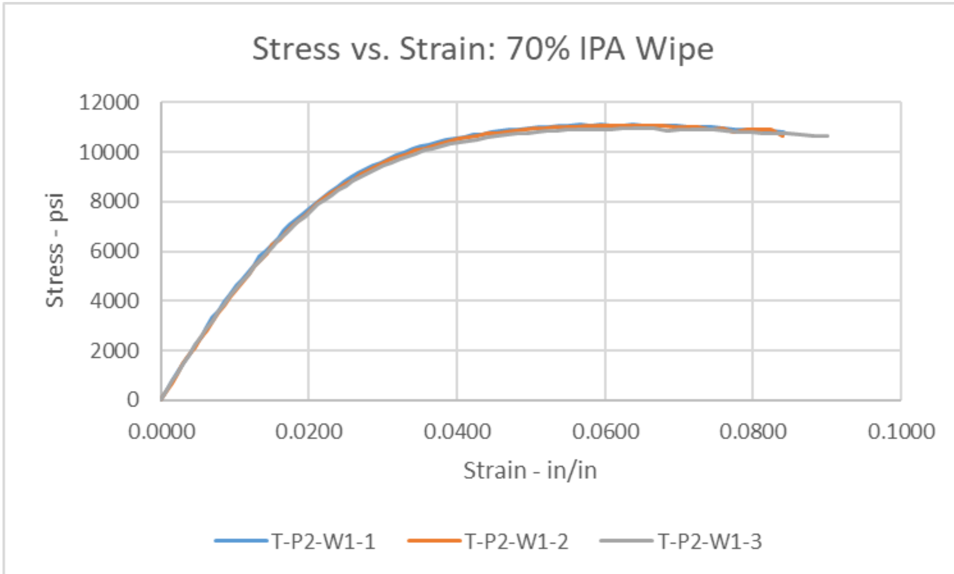


Figure C- 11. Longitudinal stress vs. strain – poly II acrylic – 70% IPA

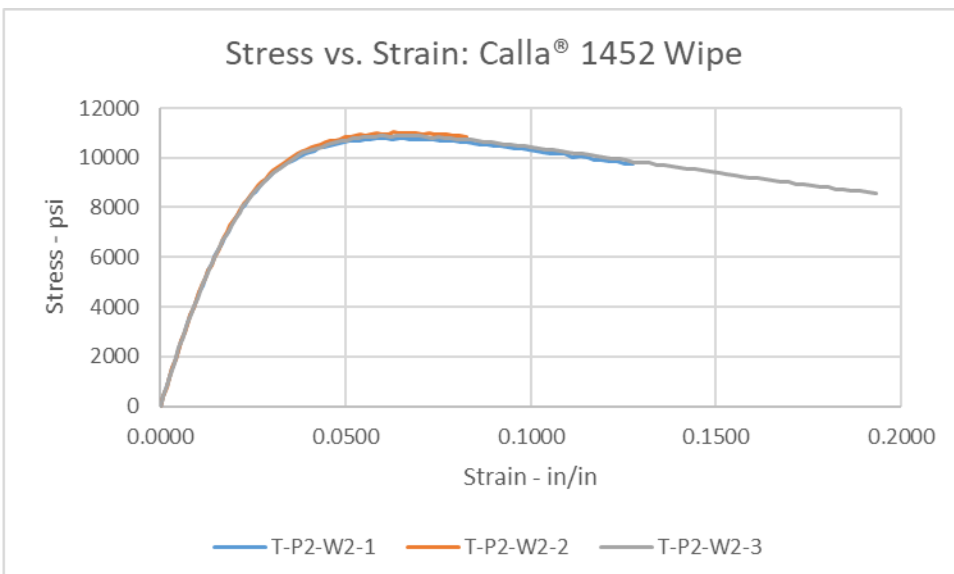


Figure C- 12. Longitudinal stress vs. strain – poly II acrylic – Calla® 1452

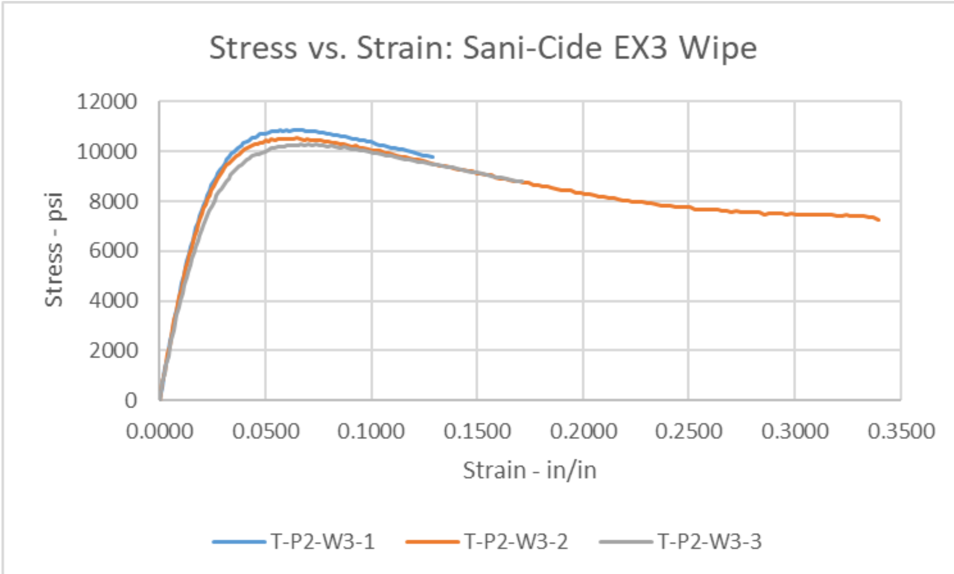


Figure C- 13. Longitudinal stress vs. strain – poly II acrylic – Sani-Cide EX3

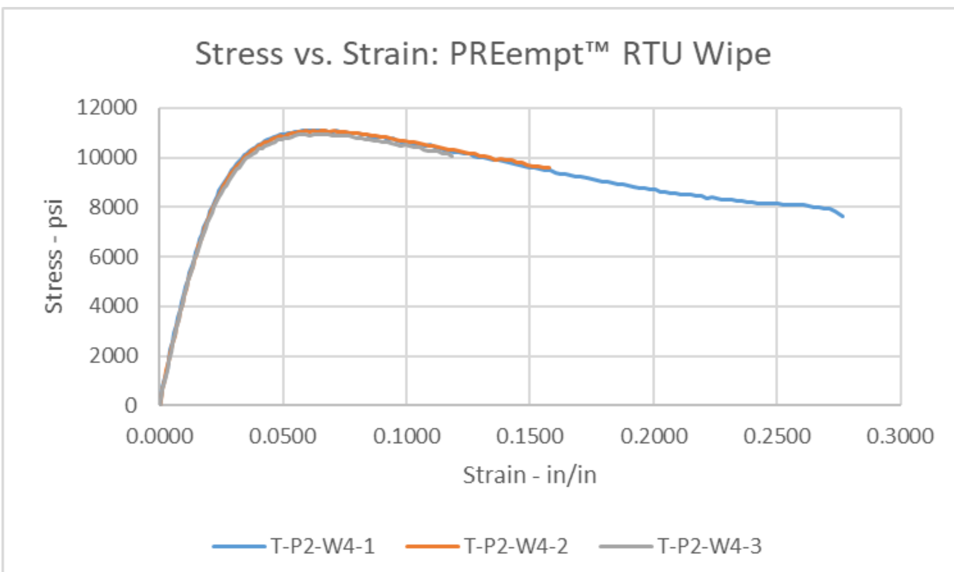


Figure C- 14. Longitudinal stress vs. strain – poly II acrylic – PREempt™ RTU

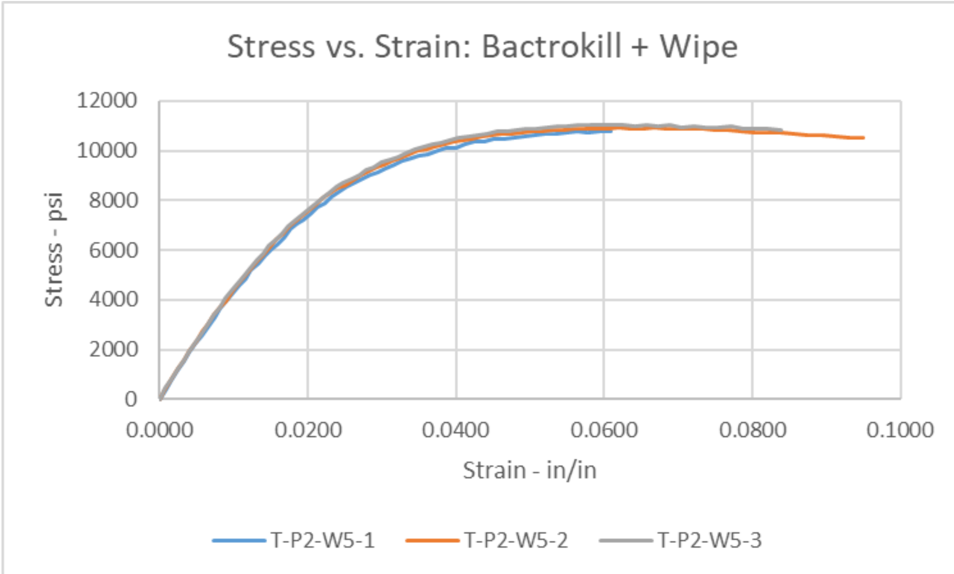


Figure C- 15. Longitudinal stress vs. strain – poly II acrylic – Bactrokill +

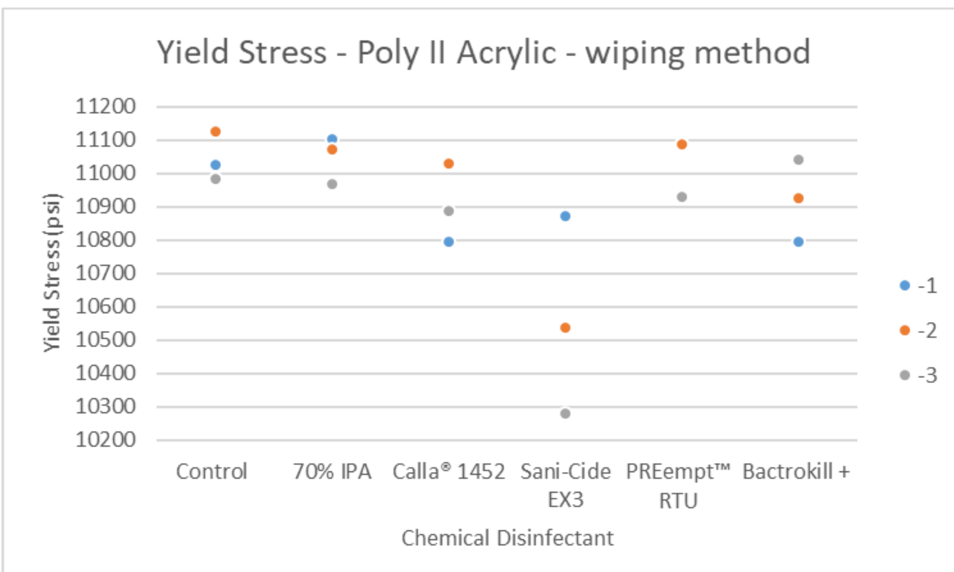


Figure C- 16. Yield stress – poly II acrylic – wiping method

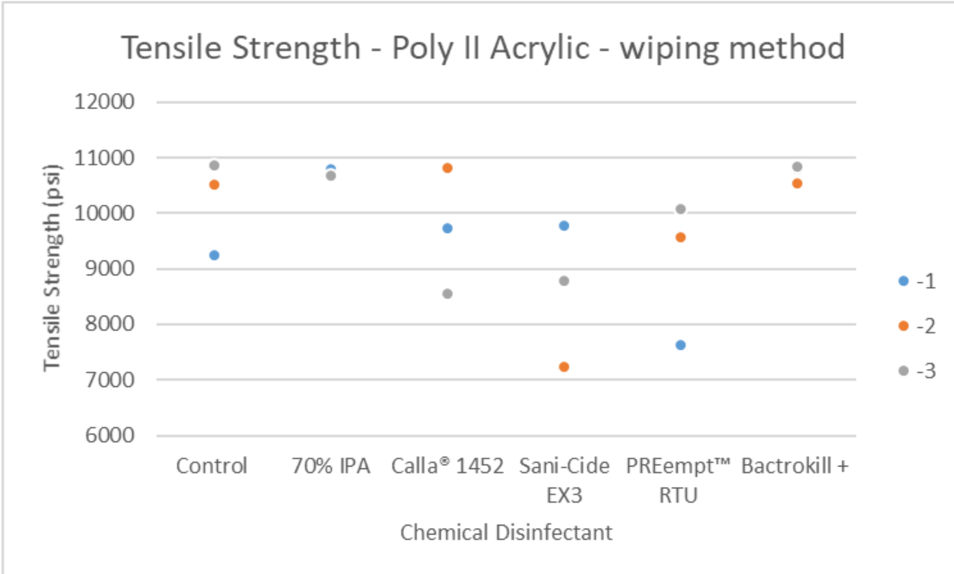


Figure C- 17. Tensile strength – poly II acrylic – wiping method

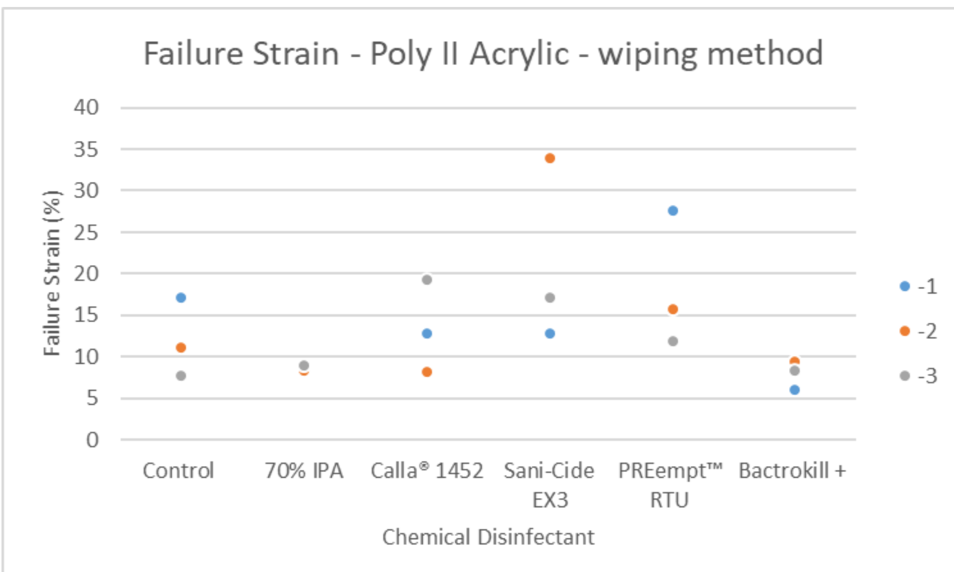


Figure C- 18. Failure strain – poly II acrylic – wiping method

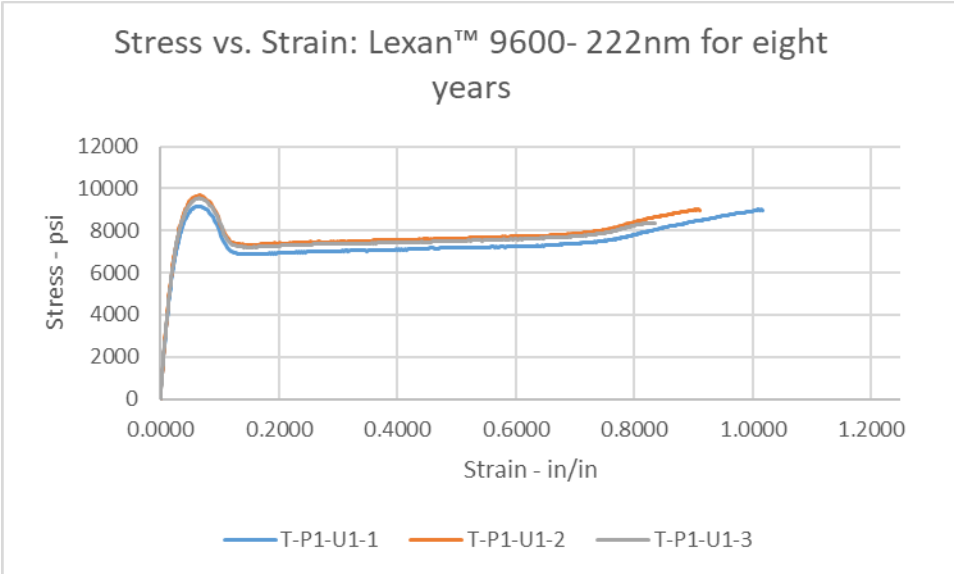


Figure C- 19. Longitudinal stress vs. strain – Lexan™ 9600 – 222 nm for eight years – UV-C method

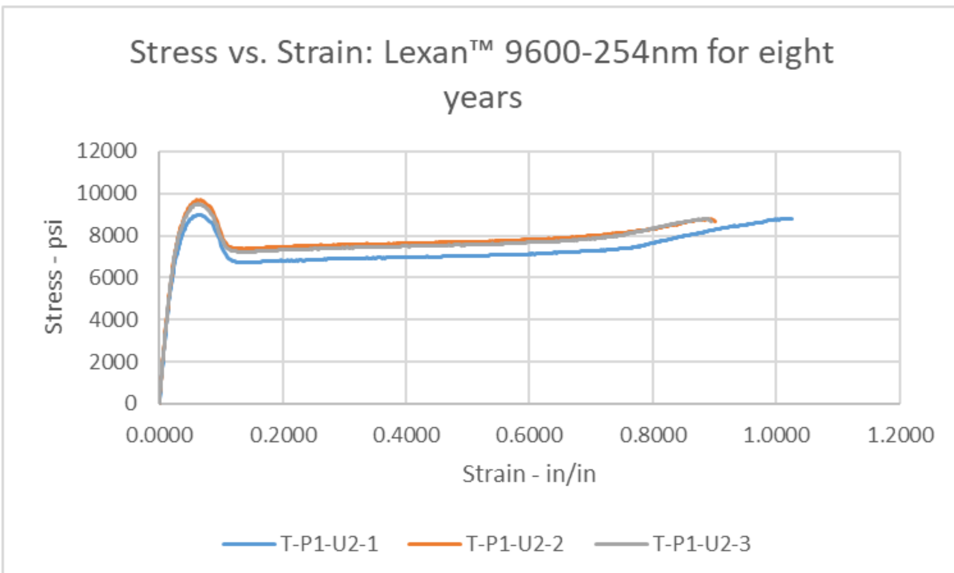


Figure C- 20. Longitudinal stress vs. strain – Lexan™ 9600 – 254 nm for eight years – UV-C method

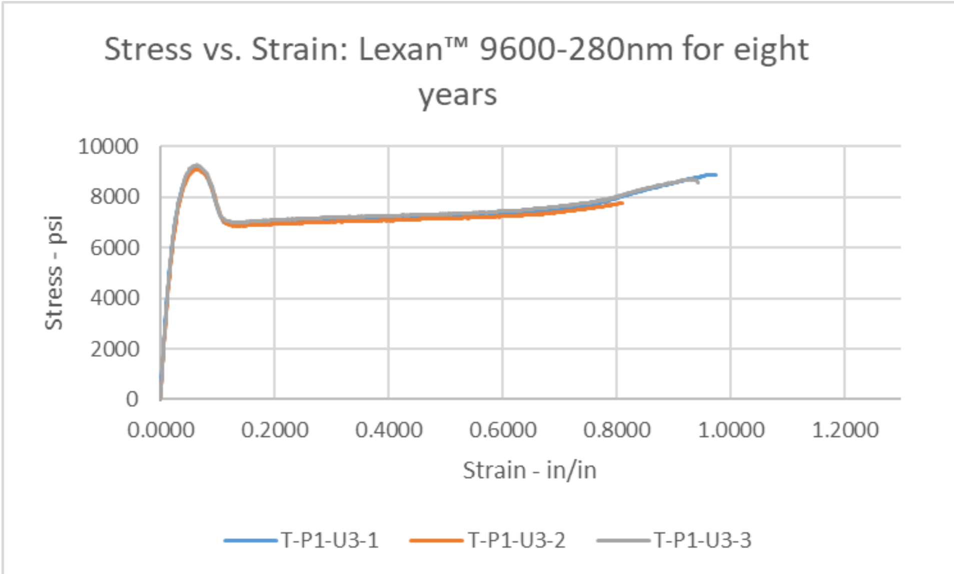


Figure C- 21. Longitudinal stress vs. strain – Lexan™ 9600 – 280 nm for eight years – UV-C method

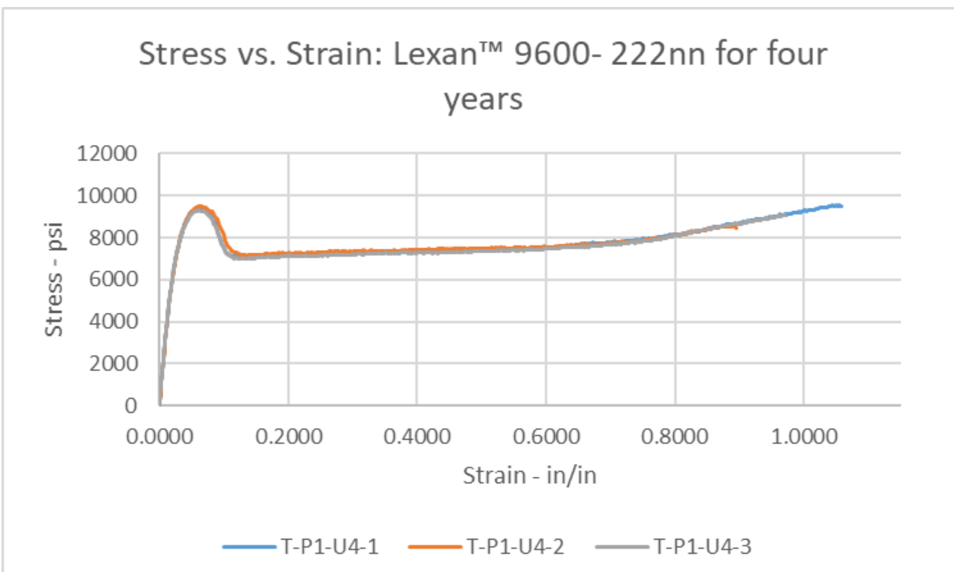


Figure C- 22. Longitudinal stress vs. strain – Lexan™ 9600 – 222 nm for four years – UV-C method

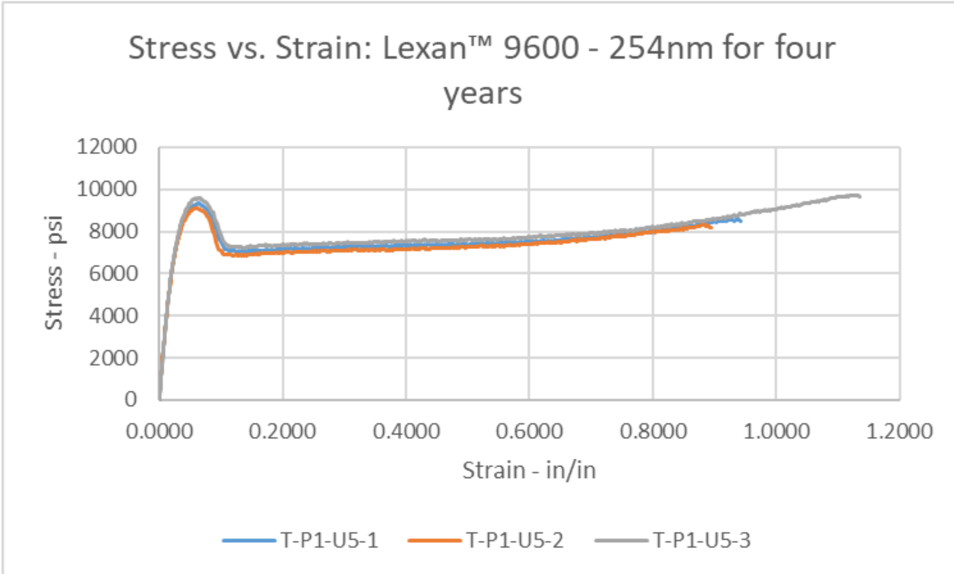


Figure C- 23. Longitudinal stress vs. strain – Lexan™ 9600 – 254 nm for four years – UV-C method

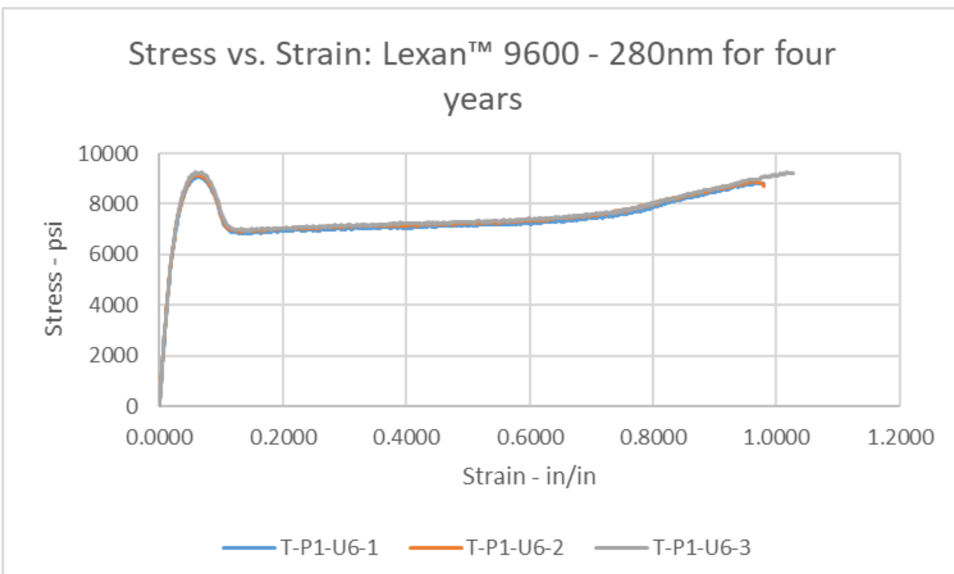


Figure C- 24. Longitudinal stress vs. strain – Lexan™ 9600 – 280 nm for four years – UV-C method

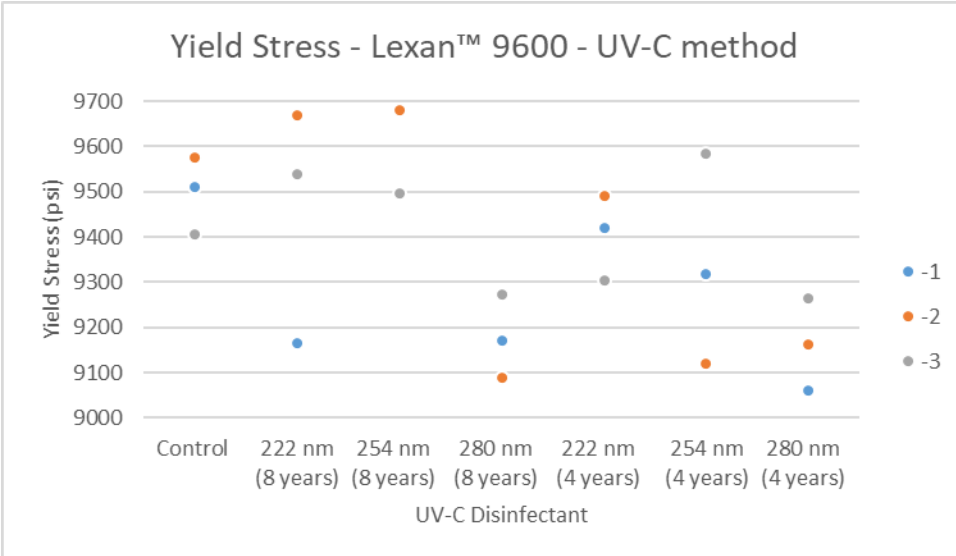


Figure C- 25. Yield stress – Lexan™ 9600 – UV-C method

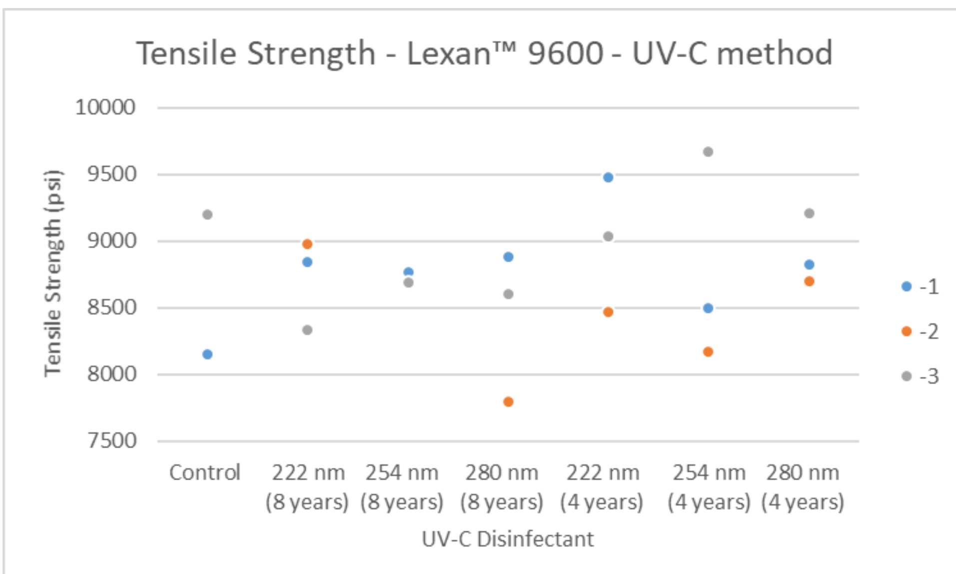


Figure C- 26. Tensile strength – Lexan™ 9600 – UV-C method

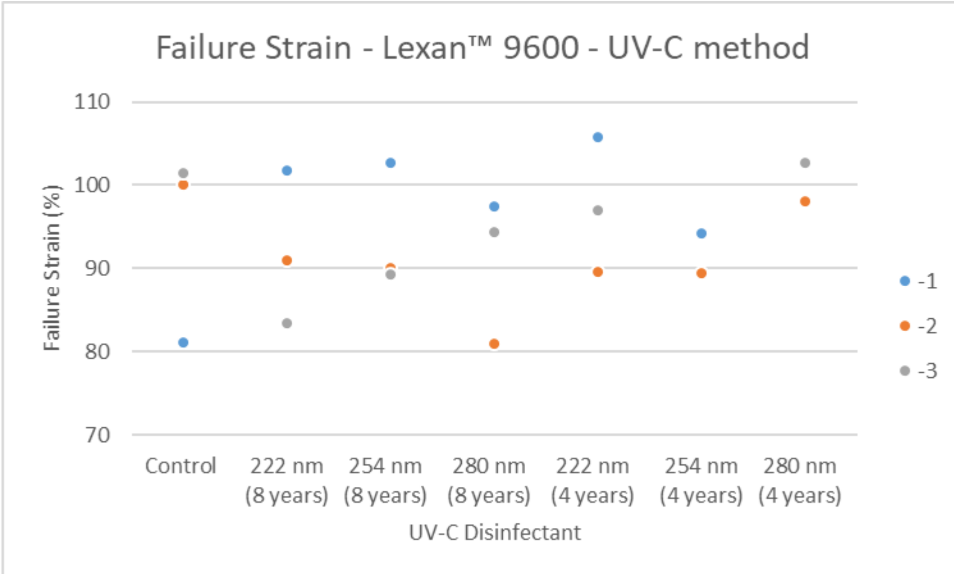


Figure C- 27. Failure strain – Lexan™ 9600 – UV-C method

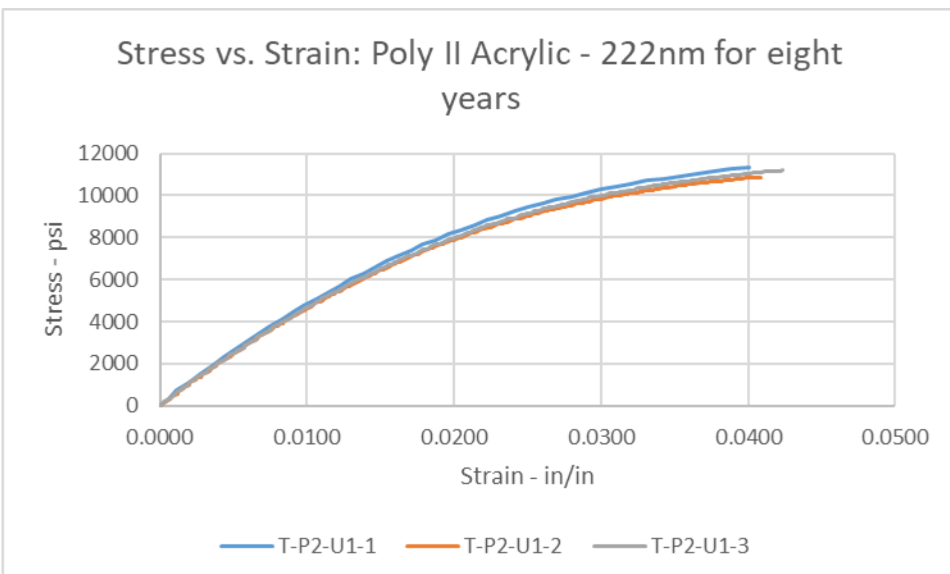


Figure C- 28. Longitudinal stress vs. strain – poly II acrylic – 222 nm for eight years – UV-C method

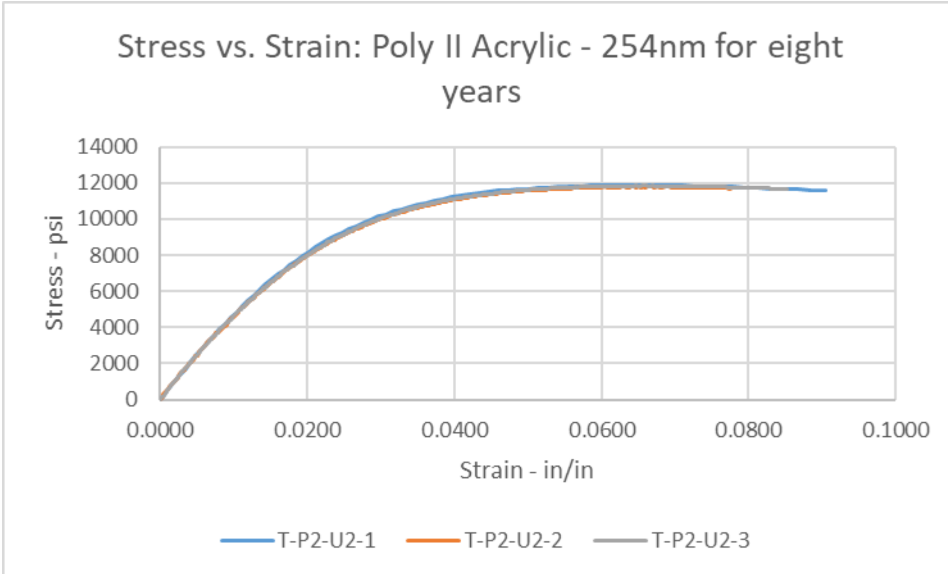


Figure C- 29. Longitudinal stress vs. strain – poly II acrylic – 254 nm for eight years – UV-C method

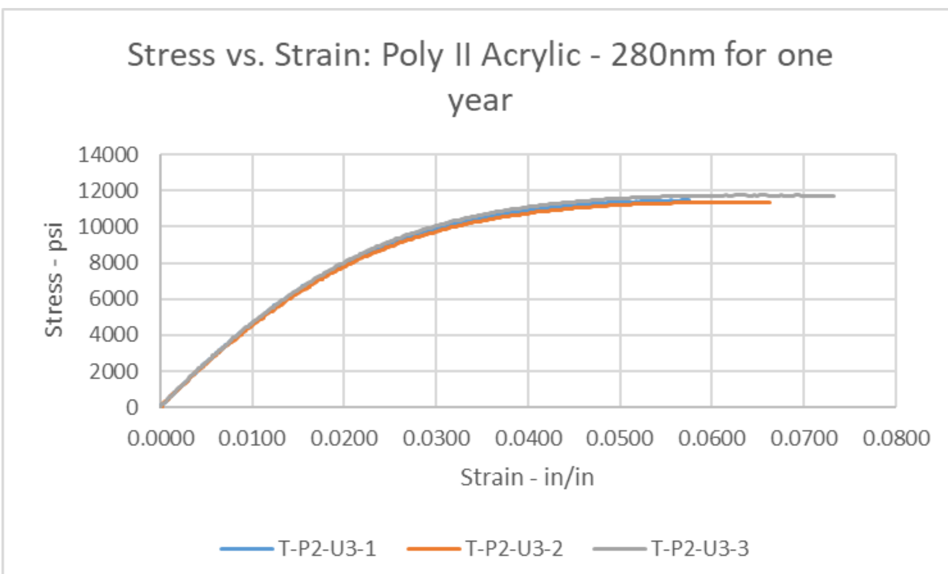


Figure C- 30. Longitudinal stress vs. strain – poly II acrylic – 280 nm for one year – UV-C method

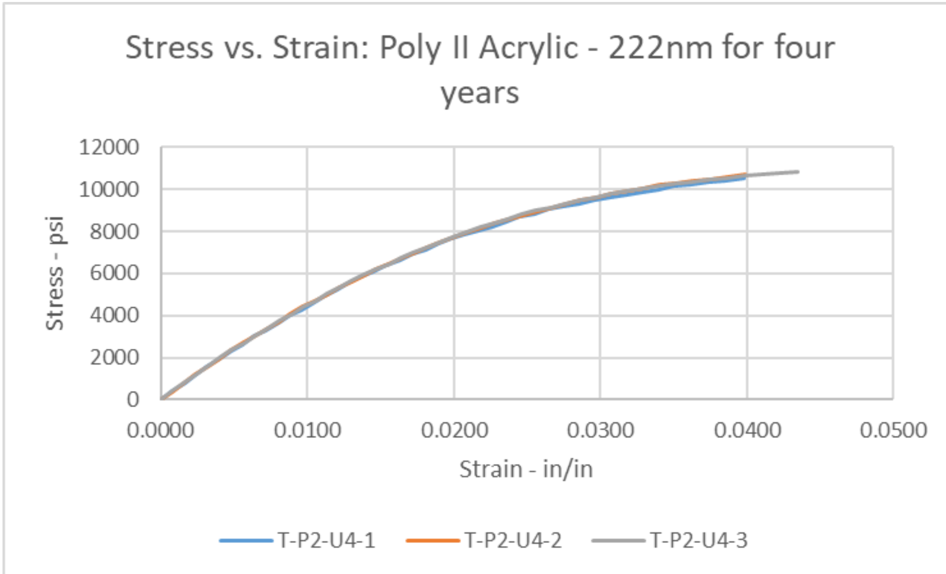


Figure C- 31. Longitudinal stress vs. strain – poly II acrylic – 222 nm for four years – UV-C method

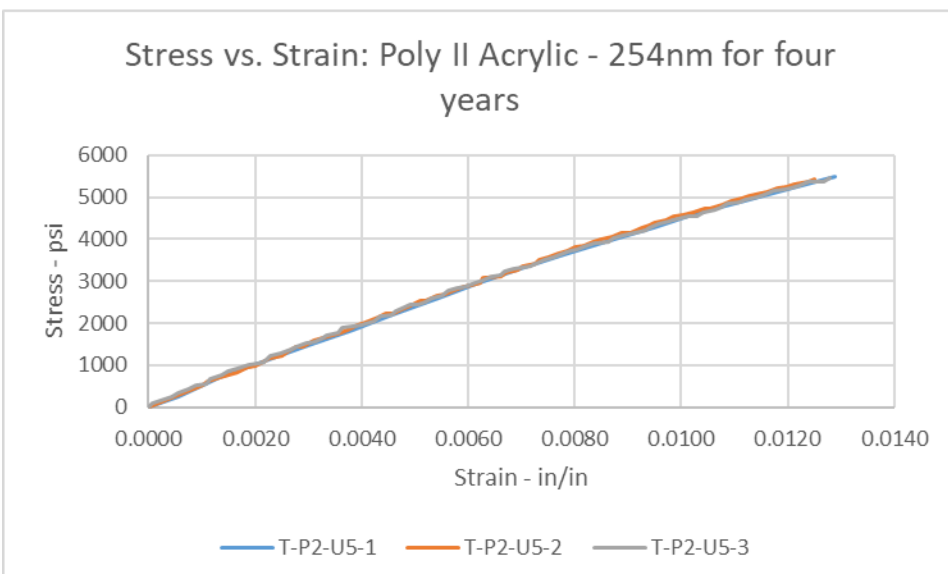


Figure C- 32. Longitudinal stress vs. strain – poly II acrylic – 254 nm for four years – UV-C method

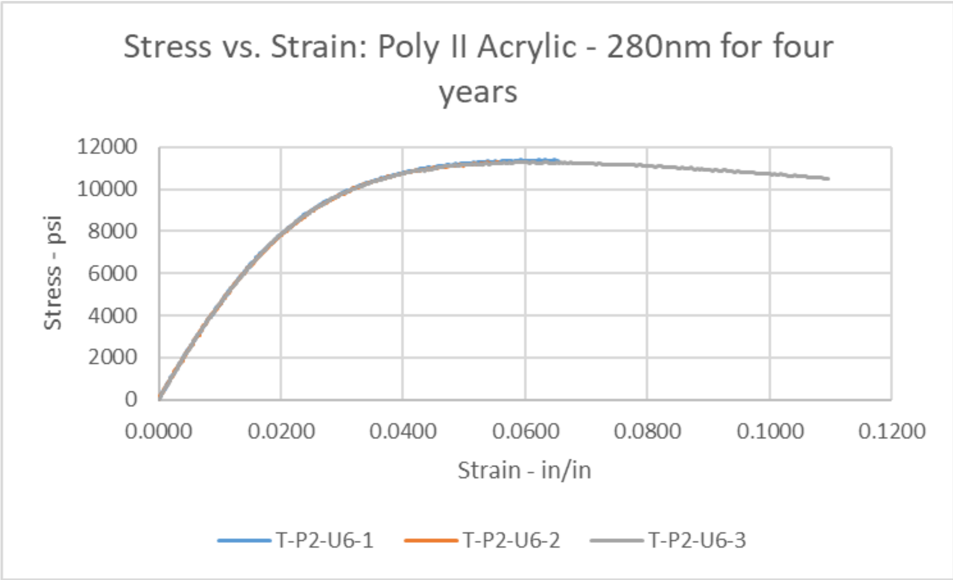


Figure C- 33. Longitudinal stress vs. strain – poly II acrylic – 280 nm for four years – UV-C method

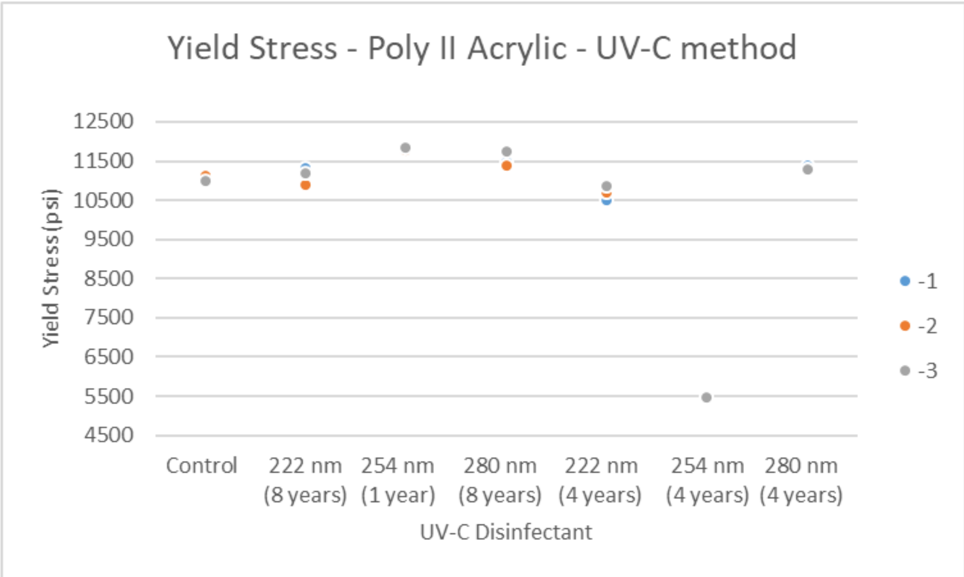


Figure C- 34. Yield stress – poly II acrylic – UV-C method

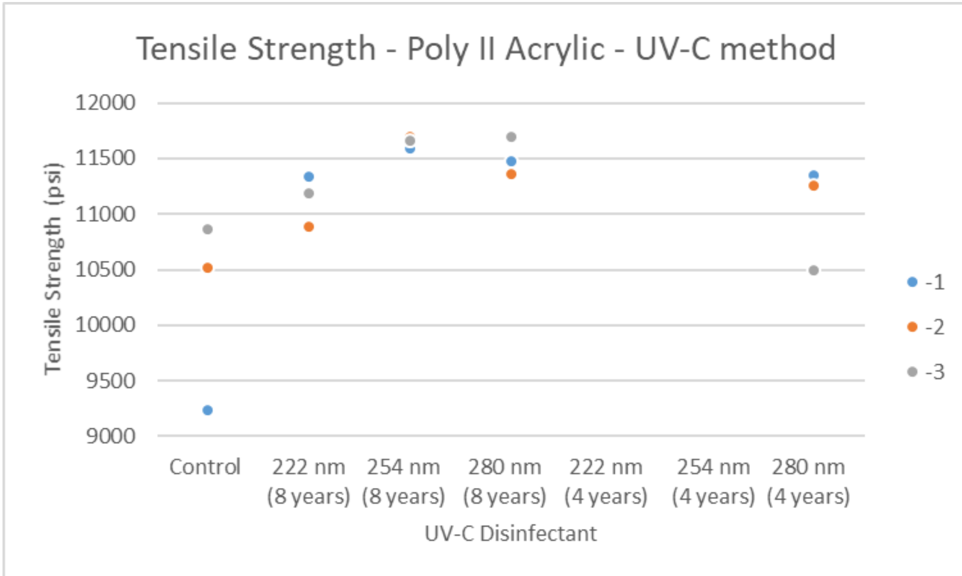


Figure C- 35. Tensile strength – poly II acrylic – UV-C method

Note. Data not collected for the 222 nm and 254 nm at four years. See section 5 for details.

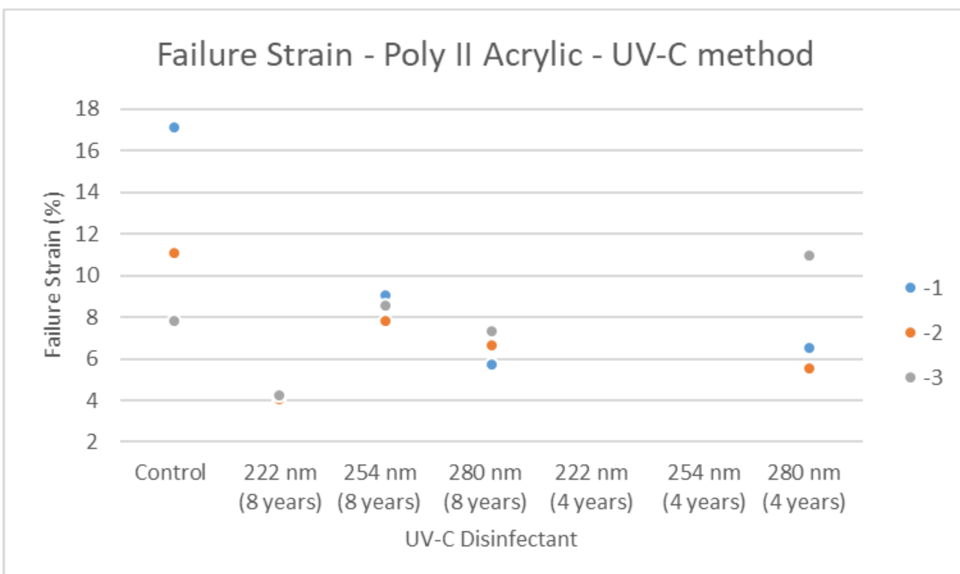


Figure C- 36. Failure strain – poly II acrylic – UV-C method

Note. Data not collected for the 222 nm and 254 nm at four years. See section 5 for details.

Table C- 3. Test photos for T-P1-C-X - Lexan™ 9600 - control

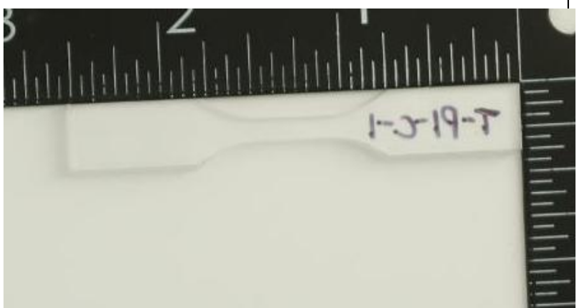
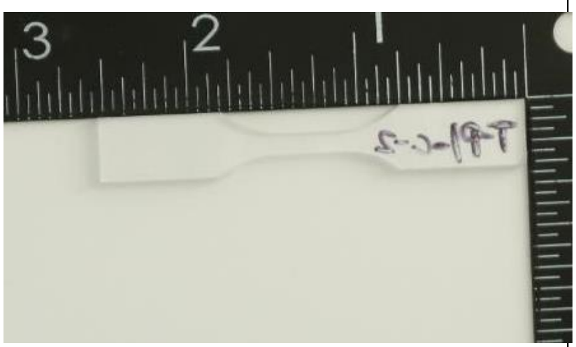
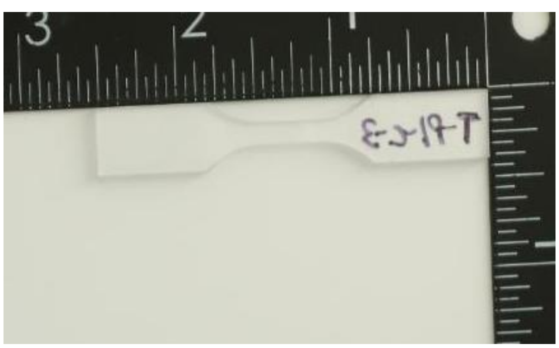
	Pre-Test	Post-Test
T-P1-C-1		
T-P1-C-2		
T-P1-C-3		

Table C- 4. Test photos for T-P1-W1-X – Lexan™ 9600 – 70% IPA- wiping method

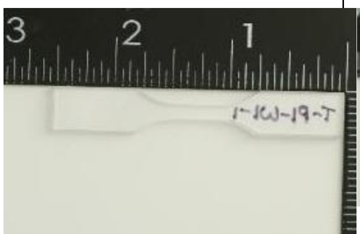
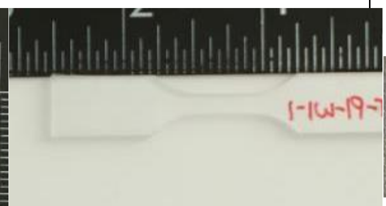
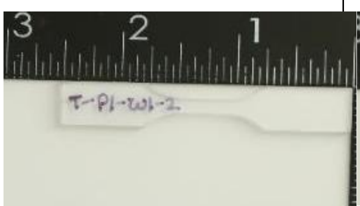
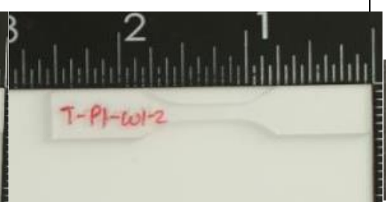
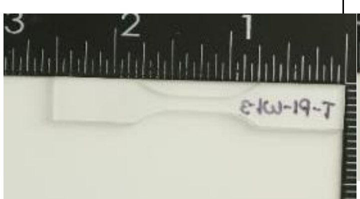
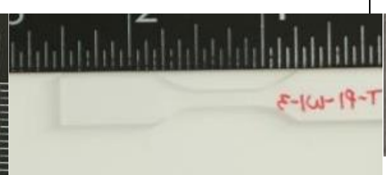
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P1-W1-1			
T-P1-W1-2			
T-P1-W1-3			

Table C- 5. Test photos for T-P1-W2-X – Lexan™ 9600 – Calla® 1452 – wiping method

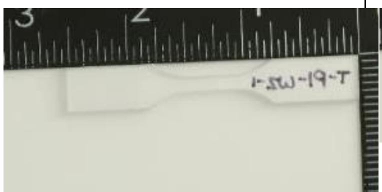
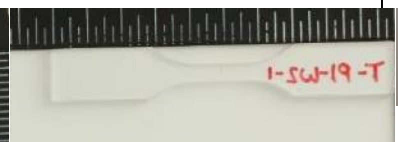
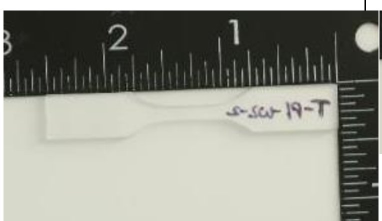
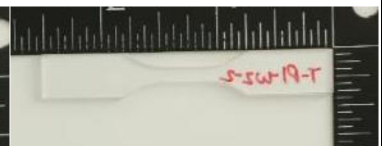
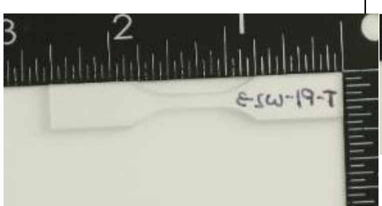
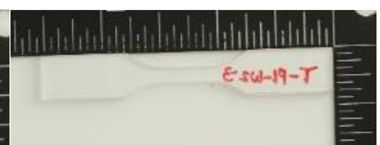
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P1-W2-1			
T-P1-W2-2			
T-P1-W2-3			

Table C- 6. Test photos for T-P1-W3-X – Lexan™ 9600 – Sani-Cide EX3 – wiping method

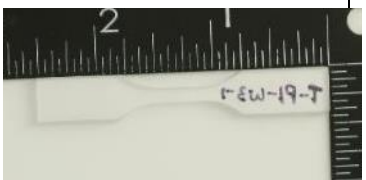
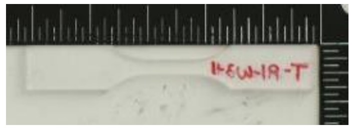
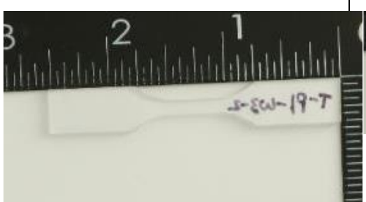
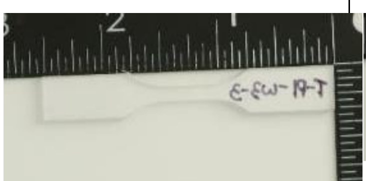
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P1-W3-1			
T-P1-W3-2			
T-P1-W3-3			

Table C- 7. Test photos for T-P1-W4-X – Lexan™ 9600 – PREempt™ RTU – wiping method

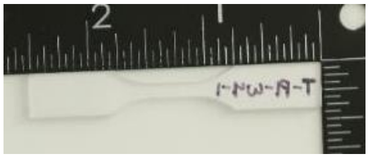
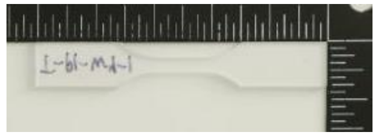
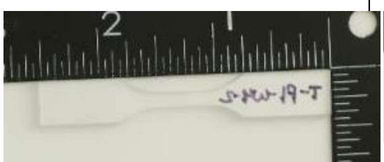
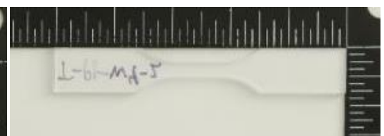
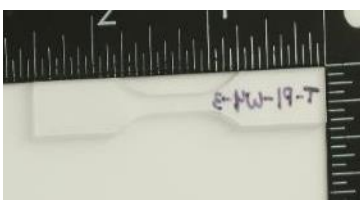
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P1-W4-1			
T-P1-W4-2			
T-P1-W4-3			

Table C- 8. Test photos for T-P1-W5-X – Lexan™ 9600 – Bactrokill + – wiping method

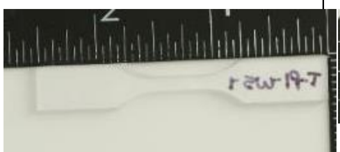
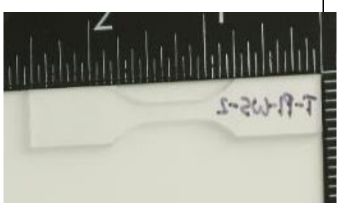
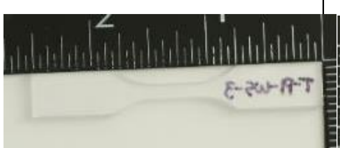
	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post- Test**
T-P1-W5-1			
T-P1-W5-2			
T-P1-W5-3			

Table C- 9. Test photos for T-P1-U1-X – Lexan™ 9600 – 222 nm for 8 years – UV-C method

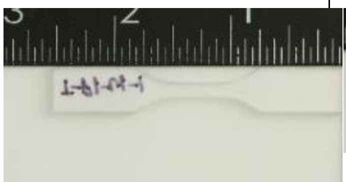
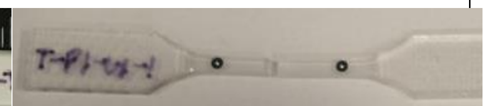
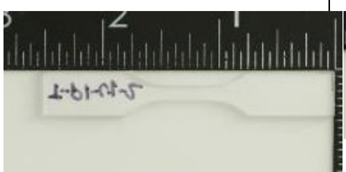
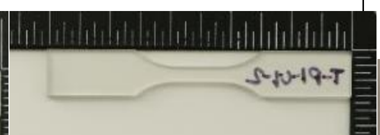
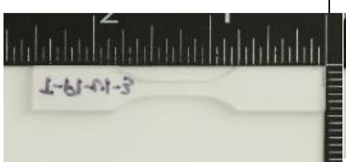
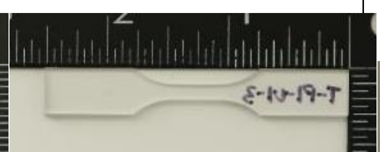
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P1-U1-1			
T-P1-U1-2			
T-P1-U1-3			

Table C- 10. Test photos for T-P1-U2-X – Lexan™ 9600 – 254 nm for 8 years – UV-C method

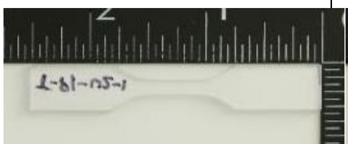
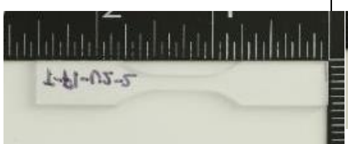
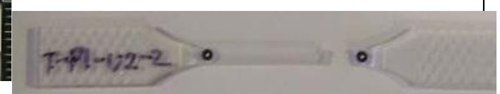
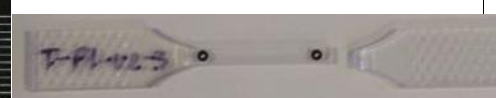
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P1-U2-1			
T-P1-U2-2			
T-P1-U2-3			

Table C- 11. Test photos for T-P1-U3-X – Lexan™ 9600 – 280 nm for 8 years – UV-C method

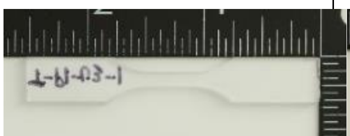
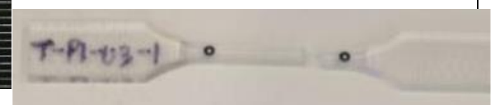
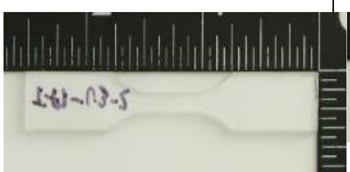
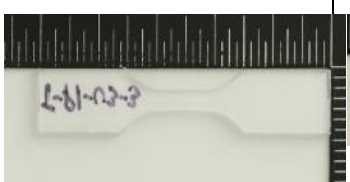
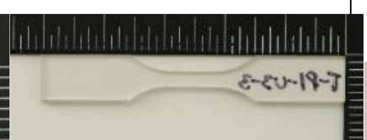
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P1-U3-1			
T-P1-U3-2			
T-P1-U3-3			

Table C- 12. Test photos for T-P1-U4-X – Lexan™ 9600 – 222 nm for four years – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P1-U4-1			
T-P1-U4-2			
T-P1-U4-3			

Table C- 13. Test photos for T-P1-U5-X – Lexan™ 9600 – 254 nm for four years – UV-C method

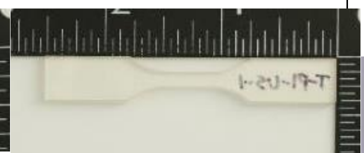
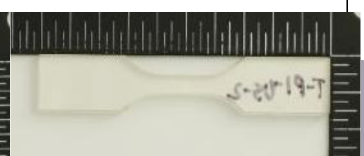
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P1-U5-1			
T-P1-U5-2			
T-P1-U5-3			

Table C- 14. Test photos for T-P1-U6-X – Lexan™ 9600 – 280 nm for four years – UV-C method

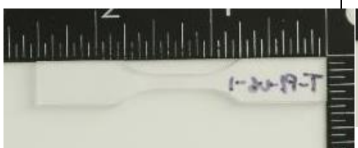
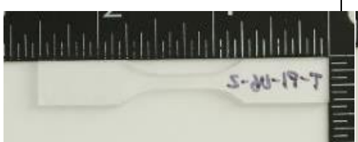
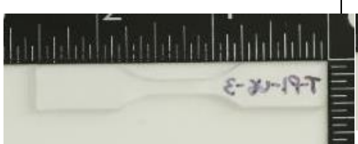
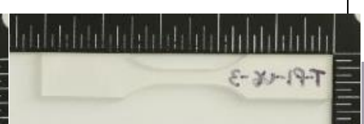
	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post- Test**
T-P1-U6-1			
T-P1-U6-2			
T-P1-U6-3			

Table C- 15. Test photos for T-P2-C-X – poly II acrylic - control

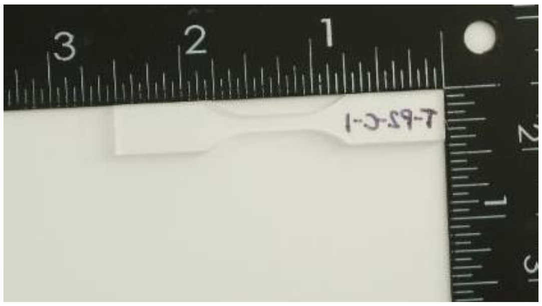
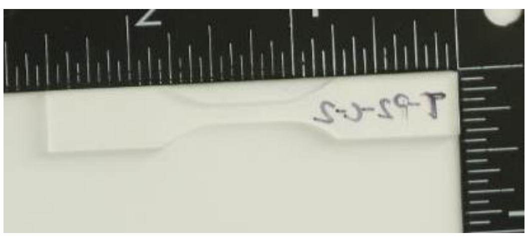
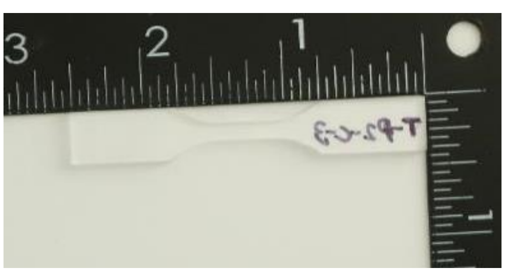
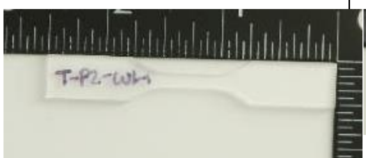
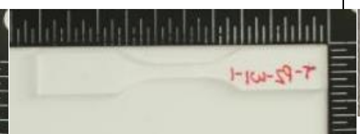
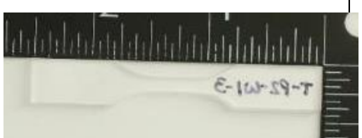
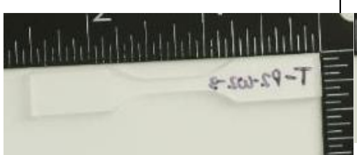
	Pre-Test	**Post-Test**
T-P2-C-1		
T-P2-C-2		
T-P2-C-3		

Table C- 16. Test photos for T-P2-W1-X – poly II acrylic – 70% IPA- wiping method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P2-W1-1			
T-P2-W1-2			
T-P2-W1-3			

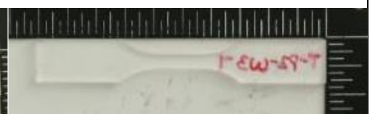
Note. The labels on the test articles came off during conditioning and had to be re-written.

Table C- 17. Test photos for T-P2-W2-X – poly II acrylic – Calla® 1452 – wiping method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P2-W2-1			
T-P2-W2-2			
T-P2-W2-3			

Note. The labels on the test articles came off during conditioning and had to be re-written.

Table C- 18. Test photos for T-P2-W3-X – poly II acrylic- Sani-Cide EX3- wiping method

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post- Test**
T-P2-W3-1			
T-P2-W3-2			
T-P2-W3-3			

Note. The labels on the test articles came off during conditioning and had to be re-written.

Table C- 19. Test photos for T-P2-W4-X – poly II acrylic- PREempt™ RTU- wiping method

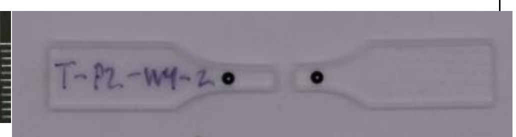
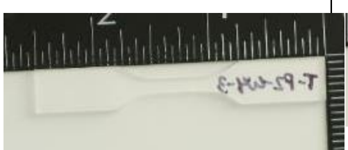
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P2-W4-1			
T-P2-W4-2			
T-P2-W4-3			

Table C- 20. Test photos for T-P2-W5-X – poly II acrylic – Bactrokill + - wiping method

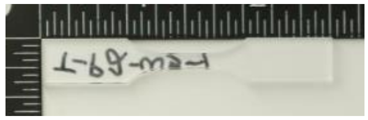
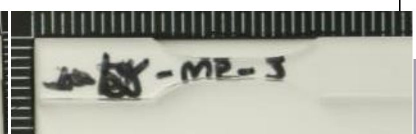
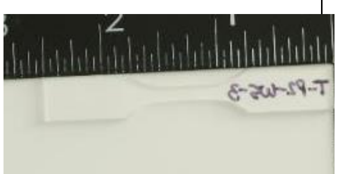
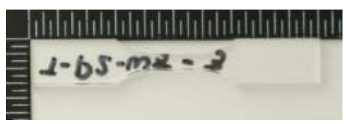
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P2-W5-1			
T-P2-W5-2			
T-P2-W5-3			

Table C- 21. Test photos for T-P2-U1-X – poly II acrylic – 222 nm for 8 years – UV-C method

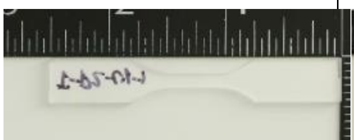
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P2-U1-1			
T-P2-U1-2			
T-P2-U1-3			

Table C- 22. Test photos for T-P2-U2-X – poly II acrylic – 254 nm for 8 years – UV-C method

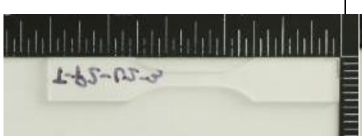
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P2-U2-1			
T-P2-U2-2			
T-P2-U2-3			

Table C- 23. Test photos for T-P2-U3-X – poly II acrylic – 280 nm for 1 year – UV-C method

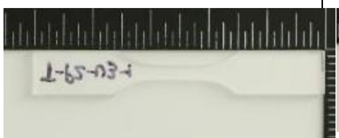
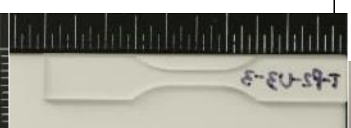
	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post- Test**
T-P2-U3-1			
T-P2-U3-2			
T-P2-U3-3			

Table C- 24. Test photos for T-P2-U4-X – poly II acrylic – 222 nm for four years – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P2-U4-1			
T-P2-U4-2			
T-P2-U4-3			

Table C- 25. Test photos for T-P2-U5-X – poly II acrylic – 254 nm for four years – UV-C method

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post- Test**
T-P2-U5-1			
T-P2-U5-2			
T-P2-U5-3			

Table C- 26. Test photos for T-P2-U6-X – poly II acrylic – 280 nm for four years – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post- Test
T-P2-U6-1			
T-P2-U6-2			
T-P2-U6-3			

D Flammability test data and photos

Table D- 1. Flammability test data – Lexan™ 9600

Test Article ID	Ignition Time (s)	Flame Time (s)	Drip Flame Time (s)	Burn Length (in)
F-P1-C-1	60.003	11	0	3.00
F-P1-C-2	60.003	11	0	3.25
F-P1-C-3	60.003	0	0	2.63
F-P1-W1-1	60.003	0	0	3.50
F-P1-W1-2	60.003	0	0	3.00
F-P1-W1-3	60.001	10	0	3.25
F-P1-W2-1	60	0	0	2.5
F-P1-W2-2	60	0	0	2.75
F-P1-W2-3	60	0	0	3.00
F-P1-W3-1	60	0	0	3.00
F-P1-W3-2	60	0	0	3.25
F-P1-W3-3	60	0	0	2.50
F-P1-W4-1	60	0	0	3.00
F-P1-W4-2	60	11	0	3.00
F-P1-W4-3	60	0	0	3.25
F-P1-W5-1	60	6	0	3.00
F-P1-W5-2	60	0	0	2.75
F-P1-W5-3	60	0	0	3.00
F-P1-U1-1	60	0	0	3.00
F-P1-U1-2	60	3	0	3.00
F-P1-U1-3	60	0	0	3.00
F-P1-U2-1	60	14	0	3.00
F-P1-U2-2	60	4	0	3.00
F-P1-U2-3	60	3	0	3.00
F-P1-U3-1	60	2	0	3.00
F-P1-U3-2	60	3	0	2.75
F-P1-U3-3	60	0	0	3.00
F-P1-U4-1	60	0	0	2.75
F-P1-U4-2	60	0	0	3.00

Test Article ID	Ignition Time (s)	Flame Time (s)	Drip Flame Time (s)	Burn Length (in)
F-P1-U4-3	60	0	0	2.75
F-P1-U5-1	60	0	0	2.75
F-P1-U5-2	60	0	0	2.75
F-P1-U5-3	60	0	0	3.00
F-P1-U6-1	60	0	0	2.75
F-P1-U6-2	60	0	0	2.50
F-P1-U6-3	60	0	0	2.75

Table D- 2. Flammability test data – poly II acrylic

Test Article ID	Ignition Time (s)	Flame Time (s)	Drip Flame Time (s)	Burn Length (in)
F-P2-C-1	60.003	276	0	11.50
F-P2-C-2	60.003	270	0	11.50
F-P2-C-3	60.003	318	0	11.50
F-P2-W1-1	60.003	258	0	11.75
F-P2-W1-2	60.003	187	0	11.75
F-P2-W1-3	60.003	210	0	11.75
F-P2-W2-1	60	240	0	11.75
F-P2-W2-2	60	189	0	11.50
F-P2-W2-3	60	220	0	11.75
F-P2-W3-1	60	213	0	11.75
F-P2-W3-2	60	185	0	11.75
F-P2-W3-3	60	219	0	11.88
F-P2-W4-1	60	200	0	12.00
F-P2-W4-2	60	200	0	11.75
F-P2-W4-3	60	205	0	11.75
F-P2-W5-1	60	185	0	11.75
F-P2-W5-2	60	502	0	11.75
F-P2-W5-3	60	225	0	12.00
F-P2-U1-1	60	258	0	11.80
F-P2-U1-2	60	268	0	11.80

Test Article ID	Ignition Time (s)	Flame Time (s)	Drip Flame Time (s)	Burn Length (in)
F-P2-U1-3	60	272	0	11.80
F-P2-U2-1	60	260	0	12.00
F-P2-U2-2	60	252	0	11.80
F-P2-U2-3	60	259	0	12.00
F-P2-U3-1	60	266	0	11.80
F-P2-U3-2	60	282	0	11.80
F-P2-U3-3	60	276	0	11.80
F-P2-U4-1	60	187	0	11.75
F-P2-U4-2	60	190	0	11.75
F-P2-U4-3	60	199	0	11.75
F-P2-U5-1	60	186	0	12.00
F-P2-U5-2	60	218	0	12.00
F-P2-U5-3	60	210	0	11.75
F-P2-U6-1	60	205	0	11.75
F-P2-U6-2	60	200	0	12.00
F-P2-U6-3	60	208	0	11.75

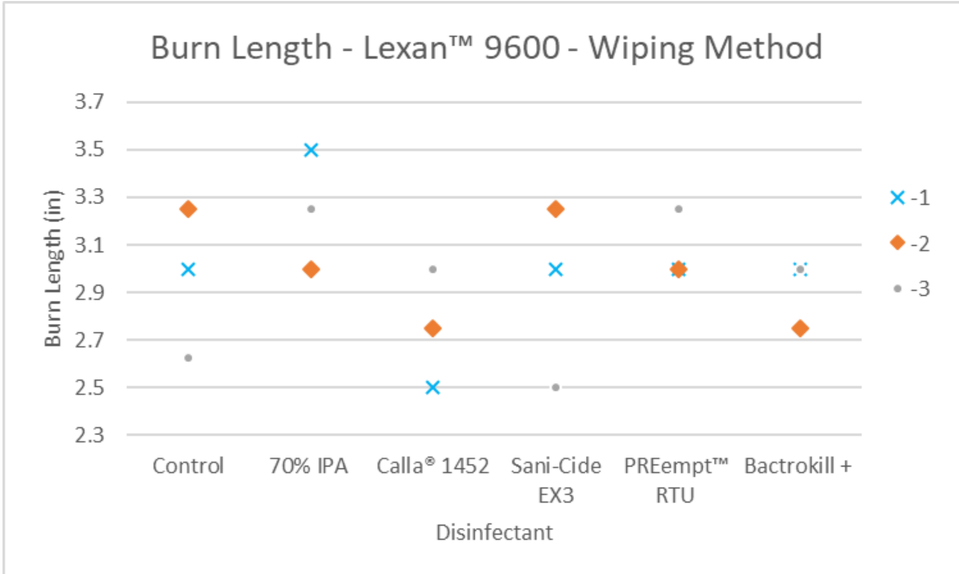


Figure D- 1. Burn length comparison – Lexan™ 9600 – wiping method

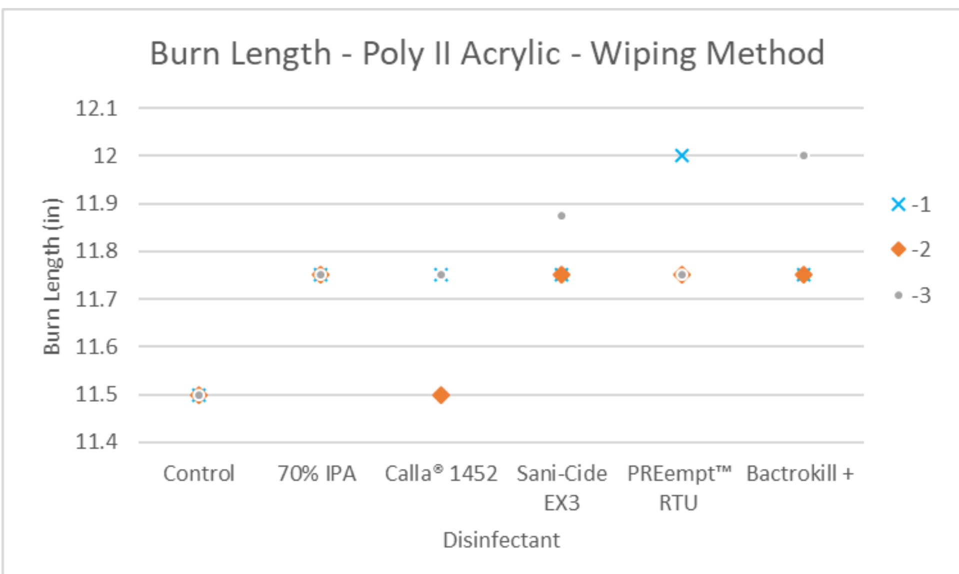


Figure D- 2. Burn length comparison – poly II acrylic – wiping method

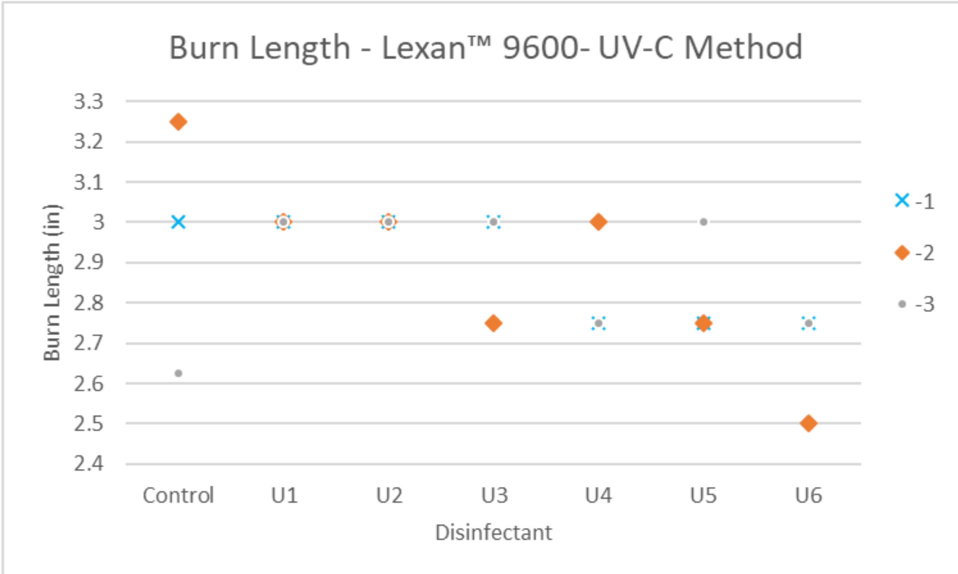


Figure D- 3. Burn length comparison – Lexan™ 9600 – UV-C method

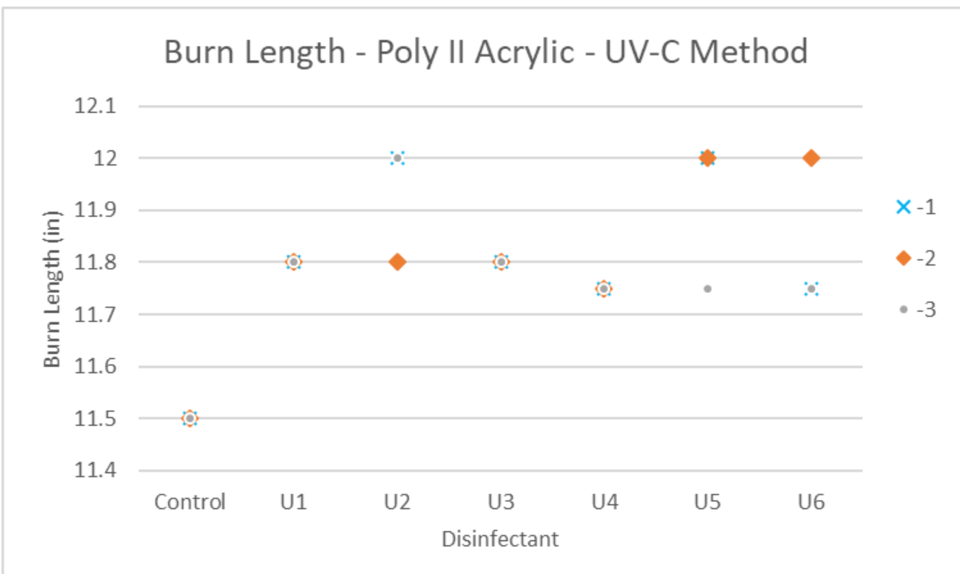


Figure D- 4. Burn length comparison – poly II acrylic – UV-C method

Table D- 3. Test photos for F-P1-C-X – Lexan™ 9600 - control

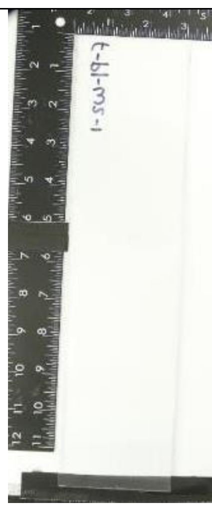
	Pre-Test	Post-Test
F-P1-C-1		
F-P1-C-2		
F-P1-C-3		

Table D- 4. Test photos for F-P1-W1-X – Lexan™ 9600 – 70% IPA – wiping method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-W1-1			
F-P1-W1-2			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-W1-3			

Table D- 5. Test photos for F-P1-W2-X– Lexan™ 9600 – Calla® 1452 – wiping method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-W2-1			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-W2-2			
F-P1-W2-3			

Table D- 6. Test photos for F-P1-W3-X – Lexan™ 9600 – Sani-Cide EX3 – wiping method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-W3-1			
F-P1-W3-2			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-W3-3			

Table D- 7. Test photos for F-P1-W4-X – Lexan™ 9600 – PREempt™ RTU – wiping method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-W4-1			

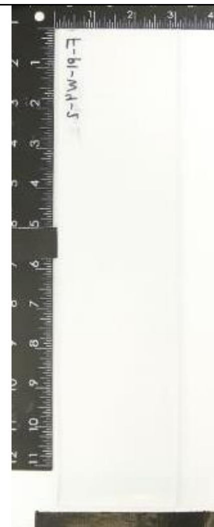
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-W4-2			
F-P1-W34-3			

Table D- 8. Test photos for F-P1-W5-X – Lexan™ 9600 – Bactrokill + - wiping method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-W5-1			
F-P1-W5-2			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-W35-3			

Table D- 9. Test photos for F-P1-U1-X – Lexan™ 9600 – 222 nm for eight years – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-U1-1			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-U1-2			
F-P1-U1-3			

Table D- 10. Test photos for F-P1-U2-X – Lexan™ 9600 – 254 nm for one year – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-U2-1			
F-P1-U2-2			

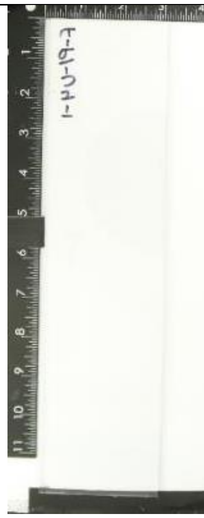
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-U2-3			

Table D- 11. Test photos for F-P1-U3-X – Lexan™ 9600 – 280 nm for eight years – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-U3-1			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-U3-2			
F-P1-U3-3			

Table D- 12. Test photos for F-P1-U4-X – Lexan™ 9600 – 222 nm for four years – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-U4-1			
F-P1-U4-2			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-U4-3			

Table D- 13. Test photos for F-P1-U5-X – Lexan™ 9600 – 254 nm for four years – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-U5-1			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-U5-2			
F-P1-U5-3			

Table D- 14. Test photos for F-P1-U6-X – Lexan™ 9600 – 280 nm for four years – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-U6-1			
F-P1-U6-2			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P1-U6-3			

Table D- 15. Test photos for F-P2-C-X – poly II acrylic - control

	Pre-Test	Post- Test
F-P2-C-1		

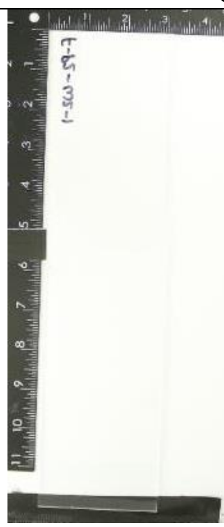
	Pre-Test	Post- Test
F-P2-C-2		
F-P2-C-3		

Table D- 16. Test photos for F-P2-W1-X – poly II acrylic – 70% IPA – wiping method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-W1-1			
F-P2-W1-2			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-W1-3			

Table D- 17. Test photos for F-P2-W2-X – poly II acrylic – Calla® 1452 – wiping method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-W2-1			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-W2-2			
F-P2-W2-3			

Table D- 18. Test photos for F-P2-W3-X – poly II acrylic – Sani-Cide EX3 – wiping method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-W3-1			
F-P2-W3-2			

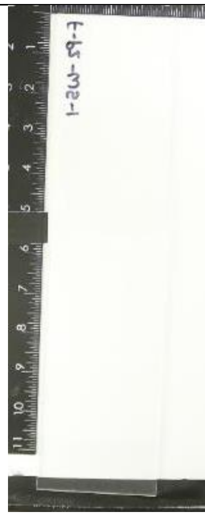
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-W3-3			

Table D- 19. Test photos for F-P2-W4-X- poly II acrylic – PREempt™ RTU – wiping method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-W4-1			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-W4-2			
F-P2-W4-3			

Table D- 20. Test photos for F-P2-W5-X – poly II acrylic – Bactrokill + - wiping method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-W5-1			
F-P2-W5-2			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-W5-3			

Table D- 21. Test photos for F-P2-U1-X – poly II acrylic – 222 nm for eight years – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-U1-1			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-U1-2			
F-P2-U1-3			

Table D- 22. Test photos for F-P2-U2-X – poly II acrylic – 254 nm for one year – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-U2-1			
F-P2-U2-2			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-U2-3			

Table D- 23. Test photos for F-P2-U3-X – poly II acrylic – 280 nm for one year – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-U3-1			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-U3-2			
F-P2-U3-3			

Table D- 24. Test photos for F-P2-U4-X – poly II acrylic – 222 nm for four years – UV-C method

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
F-P2-U4-1			
F-P2-U4-2			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-U4-3			

Table D- 25. Test photos for F-P2-U5-X – poly II acrylic – 254 nm for four years – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-U5-1			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-U5-2			
F-P2-U5-3			

Table D- 26. Test photos for F-P2-U6-X – poly II acrylic – 280 nm for four years – UV-C method

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-U6-1			
F-P2-U6-2			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
F-P2-U6-3			

E DMA test data and photos

Table E- 1. DMA test data- Lexan™ 9600

Original Test Article ID	New Test Article ID	Onset Storage Modulus – T_g(°F)	Peak of Tangent Delta – T_g(°F)
D-P1-C-1	D-P1-C-1-DMA-1	310.19	322.39
	D-P1-C-1-DMA-2	310.05	322.29
	D-P1-C-1-DMA-3	309.79	321.67
D-P1-C-2	D-P1-C-2-DMA-1	310.15	322.48
	D-P1-C-2-DMA-2	310.66	322.77
	D-P1-C-2-DMA-3	310.64	322.61
D-P1-C-3	D-P1-C-3-DMA-1	309.94	322.36
	D-P1-C-3-DMA-2	310.24	322.66
	D-P1-C-3-DMA-3	309.9	322.09
D-P1-W1-1	D-P1-W1-1-DMA-1	309.81	322.11
	D-P1-W1-1-DMA-2	309.87	322.29
	D-P1-W1-1-DMA-3	310.66	322.97
D-P1-W1-2	D-P1-W1-2-DMA-1	310.1	322.07
	D-P1-W1-2-DMA-2	309.88	322.59
	D-P1-W1-2-DMA-3	310.1	322.65
D-P1-W1-3	D-P1-W1-3-DMA-1	310.08	322.34
	D-P1-W1-3-DMA-2	309.87	322.39
	D-P1-W1-3-DMA-3	310.26	322.45
D-P1-W2-1	D-P1-W2-1-DMA-1	310.77	323.2
	D-P1-W2-1-DMA-2	310.48	322.45
	D-P1-W2-1-DMA-3	310.59	323.1
D-P1-W2-2	D-P1-W2-2-DMA-1	310.57	322.88
	D-P1-W2-2-DMA-2	311.25	323.44
	D-P1-W2-2-DMA-3	311.16	323.29
D-P1-W2-3	D-P1-W2-3-DMA-1	309.99	322.32
	D-P1-W2-3-DMA-2	310.42	322.66
	D-P1-W2-3-DMA-3	310.69	322.56
D-P1-W3-1	D-P1-W3-1-DMA-1	310.46	322.59

Original Test Article ID	New Test Article ID	Onset Storage Modulus – T_g(°F)	Peak of Tangent Delta – T_g(°F)
	D-P1-W3-1-DMA-2	309.88	322.32
	D-P1-W3-1-DMA-3	309.79	322.48
D-P1-W3-2	D-P1-W3-2-DMA-1	310.01	322.41
	D-P1-W3-2-DMA-2	310.1	322.2
	D-P1-W3-2-DMA-3	310.17	322.3
D-P1-W3-3	D-P1-W3-3-DMA-1	310.44	323.13
	D-P1-W3-3-DMA-2	309.78	322.38
D-P1-W3-3	D-P1-W3-3-DMA-3	310.28	322.81
D-P1-W4-1	D-P1-W4-1-DMA-1	310.73	322.66
	D-P1-W4-1-DMA-2	310.69	323.2
	D-P1-W4-1-DMA-3	311.14	323.13
D-P1-W4-2	D-P1-W4-2-DMA-1	311.16	323.28
	D-P1-W4-2-DMA-2	310.77	323.62
	D-P1-W4-2-DMA-3	311.07	323.49
D-P1-W4-3	D-P1-W4-3-DMA-1	310.35	322.7
	D-P1-W4-3-DMA-2	310.41	322.56
	D-P1-W4-3-DMA-3	310.73	322.74
D-P1-W5-1	D-P1-W5-1-DMA-1	310.32	322.61
	D-P1-W5-1-DMA-2	310.6	323.01
	D-P1-W5-1-DMA-3	310.5	322.77
D-P1-W5-2	D-P1-W5-2-DMA-1	310.03	322.57
	D-P1-W5-2-DMA-2	310.32	322.84
	D-P1-W5-2-DMA-3	310.78	323.04
D-P1-W5-3	D-P1-W5-3-DMA-1	310.68	322.97
	D-P1-W5-3-DMA-2	310.42	322.81
	D-P1-W5-3-DMA-3	310.66	323.24
D-P1-U1-1	D-P1-U1-1-DMA-1	315	326.98
	D-P1-U1-1-DMA-2	314.28	326.17
	D-P1-U1-1-DMA-3	313.86	326.05
D-P1-U1-2	D-P1-U1-2-DMA-1	314.67	326.48
	D-P1-U1-2-DMA-2	314.8	326.59
	D-P1-U1-2-DMA-3	314.91	327.11

Original Test Article ID	New Test Article ID	Onset Storage Modulus – T_g(°F)	Peak of Tangent Delta – T_g(°F)
D-P1-U1-3	D-P1-U1-3-DMA-1	315.77	327.81
	D-P1-U1-3-DMA-2	315.63	327.6
	D-P1-U1-3-DMA-3	315.52	327.27
D-P1-U2-1	D-P1-U2-1-DMA-1	314.76	326.44
	D-P1-U2-1-DMA-2	314.85	327
	D-P1-U2-1-DMA-3	313.99	326.08
D-P1-U2-2	D-P1-U2-2-DMA-1	314.98	326.8
	D-P1-U2-2-DMA-2	315.27	327.07
	D-P1-U2-2-DMA-3	315.12	327.06
D-P1-U2-3	D-P1-U2-3-DMA-1	314.26	326.01
	D-P1-U2-3-DMA-2	315.34	327.74
	D-P1-U2-3-DMA-3	314.82	326.91
D-P1-U3-1	D-P1-U3-1-DMA-1	314.08	326.1
D-P1-U3-1	D-P1-U3-1-DMA-2	314.01	326.07
	D-P1-U3-1-DMA-3	314.38	326.48
D-P1-U3-2	D-P1-U3-2-DMA-1	314.71	326.93
	D-P1-U3-2-DMA-2	314.58	326.61
	D-P1-U3-2-DMA-3	314.67	326.66
D-P1-U3-3	D-P1-U3-3-DMA-1	314.73	326.77
	D-P1-U3-3-DMA-2	314.82	326.59
	D-P1-U3-3-DMA-3	314.71	326.86
D-P1-U4-1	D-P1-U4-1-DMA-1	310.62	322.68
	D-P1-U4-1-DMA-2	310.68	322.99
	D-P1-U4-1-DMA-3	310.77	322.92
D-P1-U4-2	D-P1-U4-2-DMA-1	311.07	323.17
	D-P1-U4-2-DMA-2	310.89	323.17
	D-P1-U4-2-DMA-3	310.71	323.08
D-P1-U4-3	D-P1-U4-3-DMA-1	311.11	323.64
	D-P1-U4-3-DMA-2	311.02	323.47
	D-P1-U4-3-DMA-3	310.98	323.38
D-P1-U5-1	D-P1-U5-1-DMA-1	311.49	323.83
	D-P1-U5-1-DMA-2	311.13	323.47

Original Test Article ID	New Test Article ID	Onset Storage Modulus – T_g(°F)	Peak of Tangent Delta – T_g(°F)
	D-P1-U5-1-DMA-3	311.13	323.29
D-P1-U5-2	D-P1-U5-2-DMA-1	310.62	322.74
	D-P1-U5-2-DMA-2	311.04	323.17
	D-P1-U5-2-DMA-3	310.46	322.7
D-P1-U5-3	D-P1-U5-3-DMA-1	310.77	323.56
	D-P1-U5-3-DMA-2	310.91	323.01
	D-P1-U5-3-DMA-3	310.75	323.55
D-P1-U6-1	D-P1-U6-1-DMA-1	310.28	322.72
	D-P1-U6-1-DMA-2	310.35	322.97
	D-P1-U6-1-DMA-3	310.71	322.92
D-P1-U6-2	D-P1-U6-2-DMA-1	310.57	322.99
	D-P1-U6-2-DMA-2	310.68	322.83
	D-P1-U6-2-DMA-3	310.3	322.81
D-P1-U6-3	D-P1-U6-3-DMA-1	310.21	322.39
	D-P1-U6-3-DMA-2	310.64	322.74
	D-P1-U6-3-DMA-3	311.04	323.4

Table E- 2. DMA test data – poly II acrylic

Original Test Article ID	New Test Article ID	Onset Storage Modulus – T_g(°F)	Peak of Tangent Delta – T_g(°F)
D-P2-C-1	D-P2-C-1-DMA-1	228.49	261.54
	D-P2-C-1-DMA-2	227.62	260.55
	D-P2-C-1-DMA-3	229.48	261.66
D-P2-C-2	D-P2-C-2-DMA-1	228.61	261.9
	D-P2-C-2-DMA-2	227.41	260.19
	D-P2-C-2-DMA-3	228.07	261.66
D-P2-C-3	D-P2-C-3-DMA-1	228.29	261.3
	D-P2-C-3-DMA-2	228.18	261.21
	D-P2-C-3-DMA-3	228.85	262.85
D-P2-W1-1	D-P2-W1-1-DMA-1	228.42	261.05

Original Test Article ID	New Test Article ID	Onset Storage Modulus – T_g(°F)	Peak of Tangent Delta – T_g(°F)
	D-P2-W1-1-DMA-2	227.14	259.66
	D-P2-W1-1-DMA-3	227.57	260.47
D-21-W1-2	D-21-W1-2-DMA-1	227.61	261.37
	D-21-W1-2-DMA-2	227.98	259.99
	D-21-W1-2-DMA-3	227.39	260.58
D-P2-W1-3	D-P2-W1-3-DMA-1	227.35	261.86
	D-P2-W1-3-DMA-2	228.27	261.23
	D-P2-W1-3-DMA-3	227.41	260.28
D-P2-W2-1	D-P2-W2-1-DMA-1	230.13	262.78
	D-P2-W2-1-DMA-2	229.51	261.57
	D-P2-W2-1-DMA-3	230.29	263.05
D-P2-W2-2	D-P2-W2-2-DMA-1	229.37	262.29
	D-P2-W2-2-DMA-2	229.26	261.72
	D-P2-W2-2-DMA-3	229.19	261.93
D-P2-W2-3	D-P2-W2-3-DMA-1	228.87	262.81
	D-P2-W2-3-DMA-2	228.92	262.13
	D-P2-W2-3-DMA-3	229.03	262.58
D-P2-W3-1	D-P2-W3-1-DMA-1	227.37	262.29
	D-P2-W3-1-DMA-2	228.15	261.39
	D-P2-W3-1-DMA-3	227.64	262.65
D-P2-W3-2	D-P2-W3-2-DMA-1	228.06	261.19
	D-P2-W3-2-DMA-2	227.46	261.7
	D-P2-W3-2-DMA-3	228.13	261.21
D-P2-W3-3	D-P2-W3-3-DMA-1	227.21	260.35
	D-P2-W3-3-DMA-2	227.52	261.41
	D-P2-W3-3-DMA-3	227.62	262.17
D-P2-W4-1	D-P2-W4-1-DMA-1	229.06	263.44
D-P2-W4-1	D-P2-W4-1-DMA-2	228.99	263.26
	D-P2-W4-1-DMA-3	229.86	264.27
D-P2-W4-2	D-P2-W4-2-DMA-1	228.97	262.2
	D-P2-W4-2-DMA-2	229.53	263.25
	D-P2-W4-2-DMA-3	230.36	263.62

Original Test Article ID	New Test Article ID	Onset Storage Modulus – T_g(°F)	Peak of Tangent Delta – T_g(°F)
D-P2-W4-3	D-P2-W4-3-DMA-1	229.69	262.74
	D-P2-W4-3-DMA-2	229.8	262.56
	D-P2-W4-3-DMA-3	229.82	262.24
D-P2-W5-1	D-P2-W5-1-DMA-1	229.06	262.9
	D-P2-W5-1-DMA-2	228.49	261.39
	D-P2-W5-1-DMA-3	229.64	263.82
D-P2-W5-2	D-P2-W5-2-DMA-1	230.58	263.03
	D-P2-W5-2-DMA-2	229.62	262.87
	D-P2-W5-2-DMA-3	229.42	262.35
D-P2-W5-3	D-P2-W5-3-DMA-1	230.31	263.25
	D-P2-W5-3-DMA-2	230.7	264.43
	D-P2-W5-3-DMA-3	228.92	263.32
D-P2-U1-1	D-P2-U1-1-DMA-1	237.63	269.02
	D-P2-U1-1-DMA-2	236.59	267.84
	D-P2-U1-1-DMA-3	236.91	268.45
D-P2-U1-2	D-P2-U1-2-DMA-1	236.19	268.2
	D-P2-U1-2-DMA-2	236.61	267.76
	D-P2-U1-2-DMA-3	236.88	267.48
D-P2-U1-3	D-P2-U1-3-DMA-1	237.25	268.66
	D-P2-U1-3-DMA-2	236.7	267.8
	D-P2-U1-3-DMA-3	237.11	268.29
D-P2-U2-1	D-P2-U2-1-DMA-1	237.11	268.39
	D-P2-U2-1-DMA-2	237.52	268
	D-P2-U2-1-DMA-3	237.33	268.68
D-P2-U2-2	D-P2-U2-2-DMA-1	236.8	267.96
	D-P2-U2-2-DMA-2	237.92	269.53
	D-P2-U2-2-DMA-3	236.91	267.94
D-P2-U2-3	D-P2-U2-3-DMA-1	237.09	268.07
	D-P2-U2-3-DMA-2	236.37	267.44
	D-P2-U2-3-DMA-3	236.43	267.6
D-P2-U3-1	D-P2-U3-1-DMA-1	236.93	269.15
	D-P2-U3-1-DMA-2	237.94	269.46

Original Test Article ID	New Test Article ID	Onset Storage Modulus – T_g(°F)	Peak of Tangent Delta – T_g(°F)
	D-P2-U3-1-DMA-3	236.95	268.11
D-P2-U3-2	D-P2-U3-2-DMA-1	237.56	268.75
	D-P2-U3-2-DMA-2	237.11	268.74
	D-P2-U3-2-DMA-3	236.89	267.84
D-P2-U3-3	D-P2-U3-3-DMA-1	237.09	268.16
	D-P2-U3-3-DMA-2	237.04	269.11
	D-P2-U3-3-DMA-3	237.58	269.87
D-P2-U4-1	D-P2-U4-1-DMA-1	230.56	262.83
	D-P2-U4-1-DMA-2	230.9	262.6
	D-P2-U4-1-DMA-3	230.74	263.44
D-P2-U4-2	D-P2-U4-2-DMA-1	230.74	264.07
	D-P2-U4-2-DMA-2	231.46	263.05
	D-P2-U4-2-DMA-3	231.19	263.43
D-P2-U4-3	D-P2-U4-3-DMA-1	231.49	264.18
	D-P2-U4-3-DMA-2	231.42	263.64
	D-P2-U4-3-DMA-3	230.85	263.34
D-P2-U5-1	D-P2-U5-1-DMA-1	231.48	263.57
	D-P2-U5-1-DMA-2	230.97	263.17
	D-P2-U5-1-DMA-3	231.3	263.03
D-P2-U5-2	D-P2-U5-2-DMA-1	230.52	262.13
	D-P2-U5-2-DMA-2	230.67	263.55
	D-P2-U5-2-DMA-3	230.43	262.85
D-P2-U5-3	D-P2-U5-3-DMA-1	230.9	263.23
	D-P2-U5-3-DMA-2	231.22	261.95
	D-P2-U5-3-DMA-3	231.15	262.98
D-P2-U6-1	D-P2-U6-1-DMA-1	230.83	263.62
	D-P2-U6-1-DMA-2	230.95	263.71
	D-P2-U6-1-DMA-3	230.52	264.49
D-P2-U6-2	D-P2-U6-2-DMA-1	232.12	264.24
	D-P2-U6-2-DMA-2	230.72	262.99
	D-P2-U6-2-DMA-3	230.65	264.04
D-P2-U6-3	D-P2-U6-3-DMA-1	230.67	263.88

Original Test Article ID	New Test Article ID	Onset Storage Modulus – T_g(°F)	Peak of Tangent Delta – T_g(°F)
	D-P2-U6-3-DMA-2	230.14	262.54
	D-P2-U6-3-DMA-3	231.06	264.4

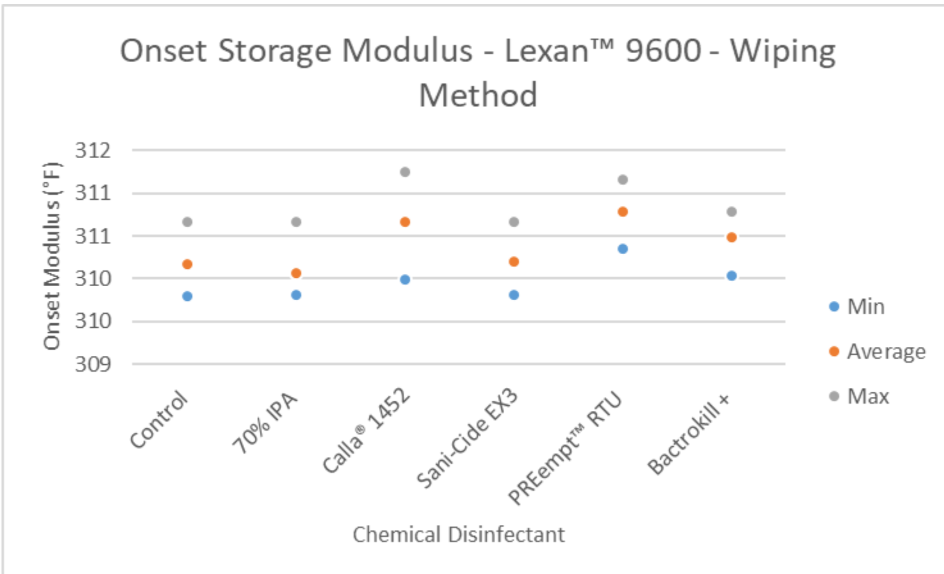


Figure E- 1. Onset storage modulus – Lexan™ 9600 – wiping method

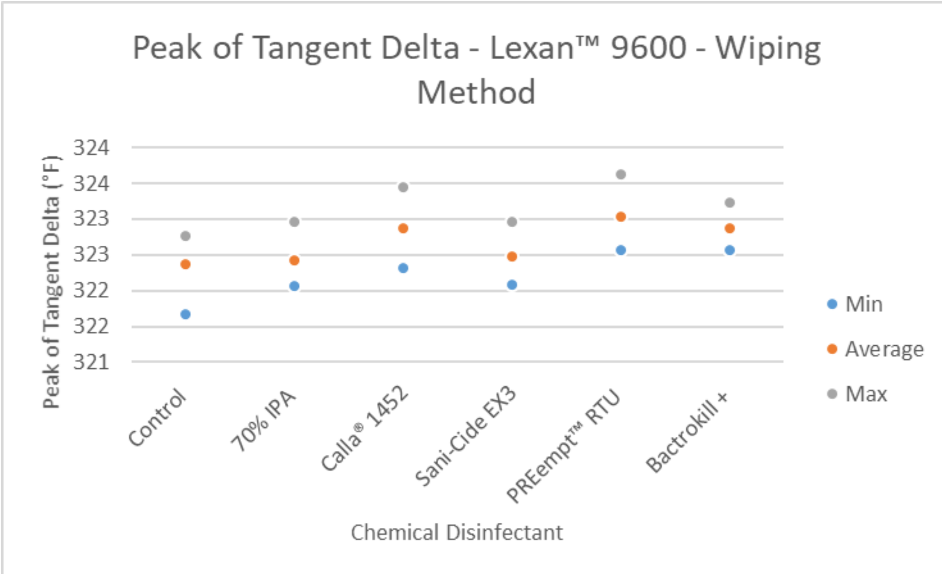


Figure E- 2. Peak of tangent delta – Lexan™ 9600 – wiping method

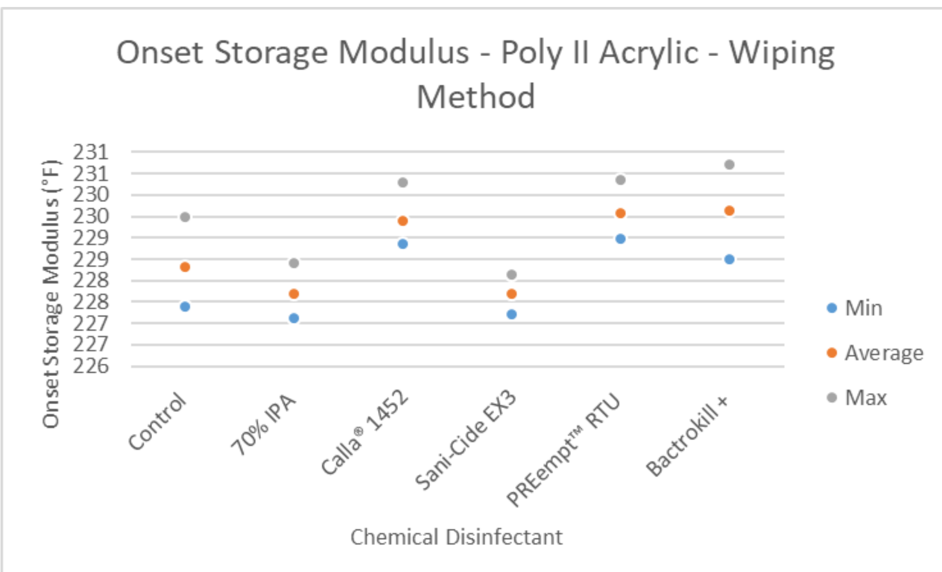


Figure E- 3. Onset storage modulus – poly II acrylic – wiping method

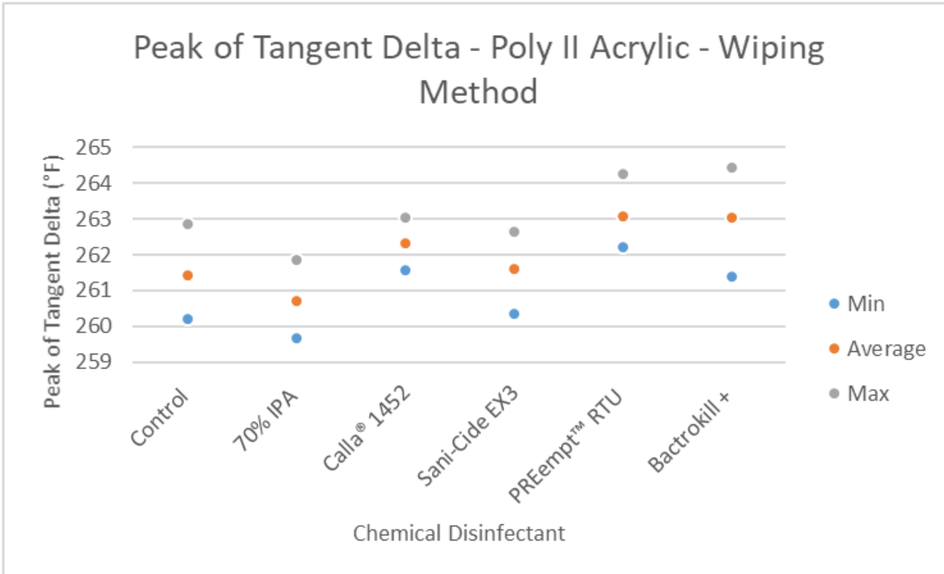


Figure E- 4. Peak of tangent delta – poly II acrylic – wiping method

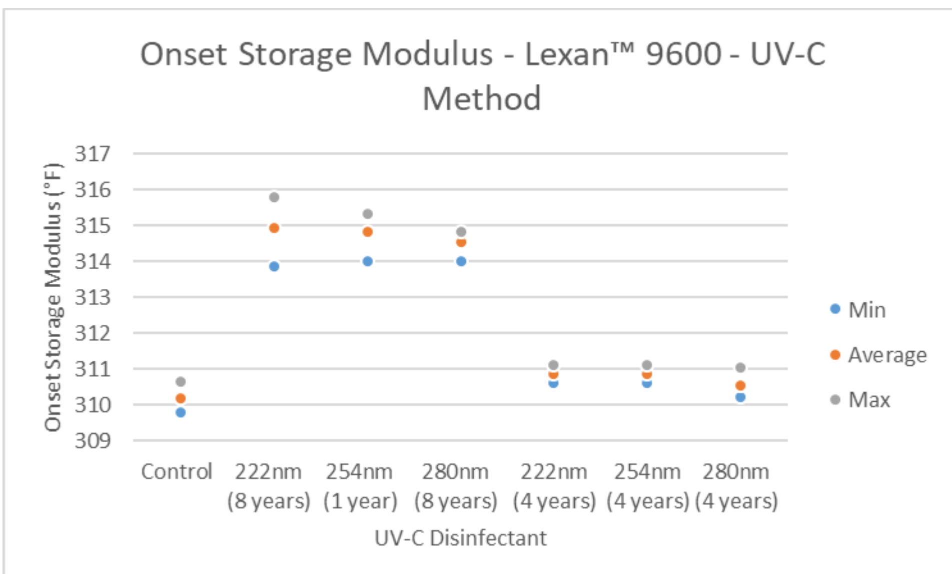


Figure E- 5. Onset storage modulus – Lexan™ 9600 – UV-C method

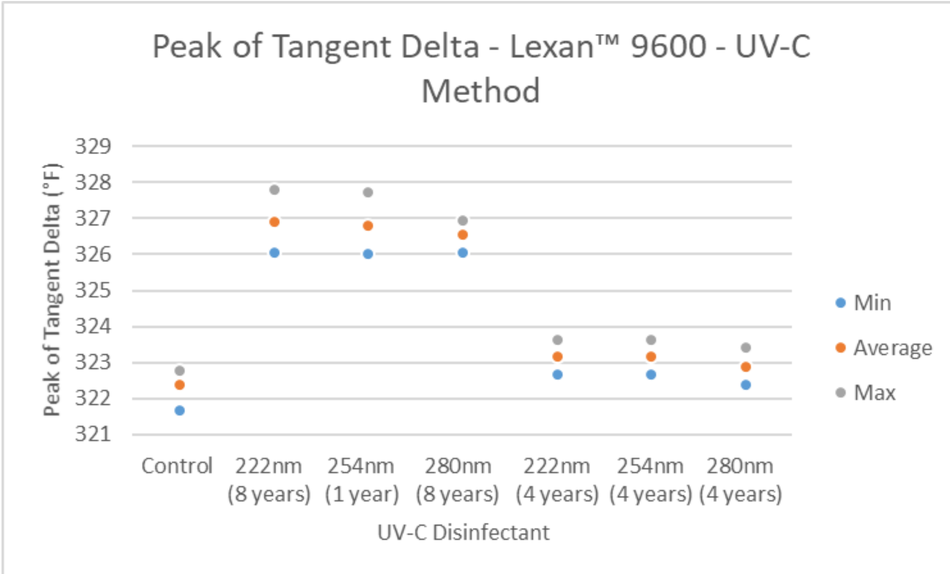


Figure E- 6. Peak of tangent delta – Lexan™ 9600 – UV-C method

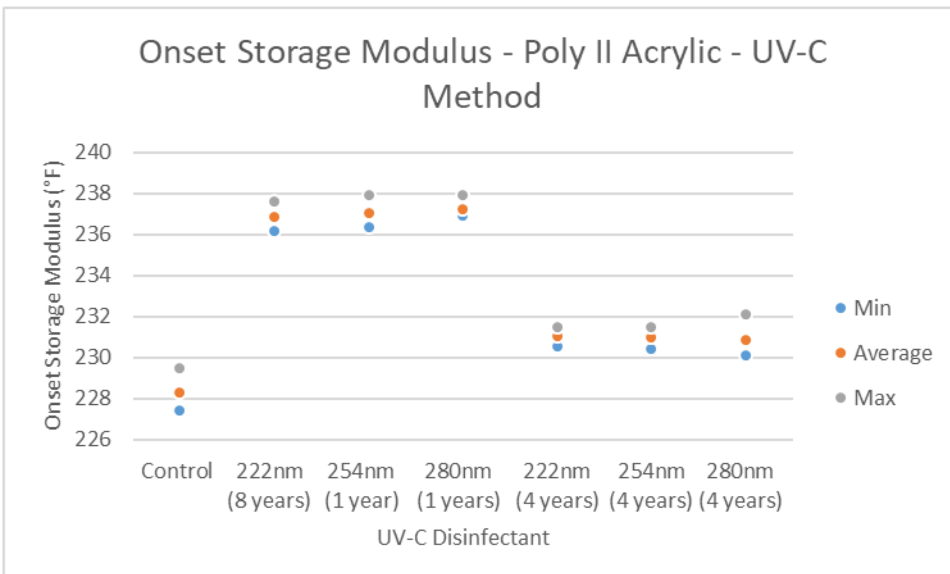


Figure E- 7. Onset storage modulus – poly II acrylic – UV-C method

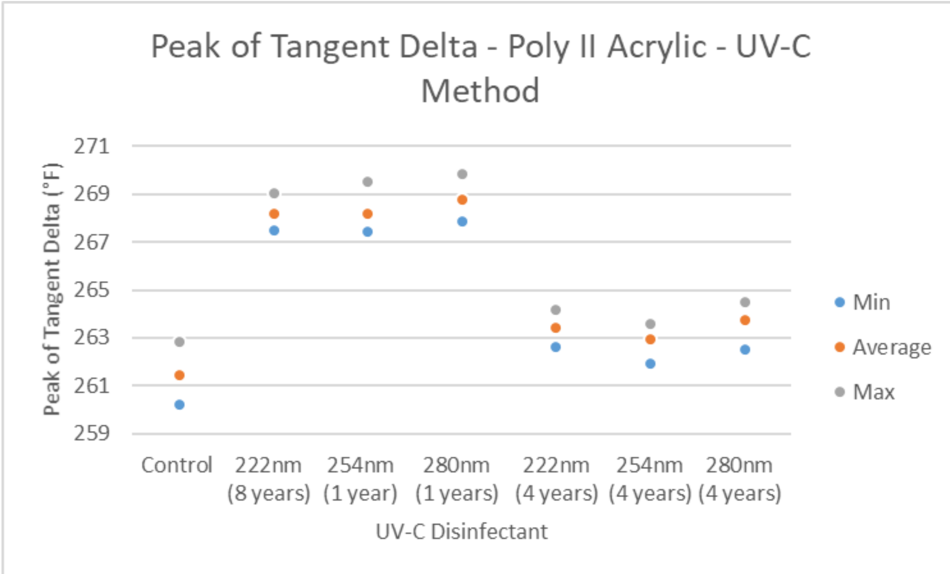


Figure E- 8. Peak of tangent delta – poly II acrylic – UV-C method

Table E- 3. Test photos for D-P1-C-X – Lexan™ 9600 – control

	Check-In
D-P1-C-1	
D-P1-C-2	
D-P1-C-3	

Table E- 4. Test photos for D-P1-W1-X – Lexan™ 9600 – 70% IPA – wiping method

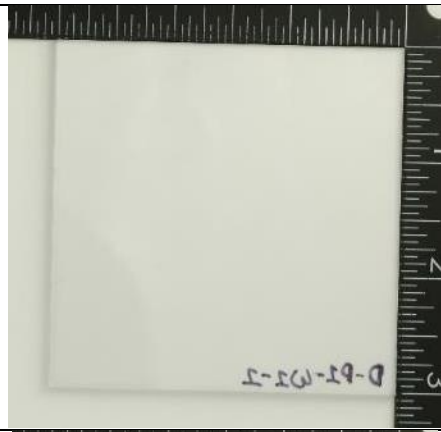
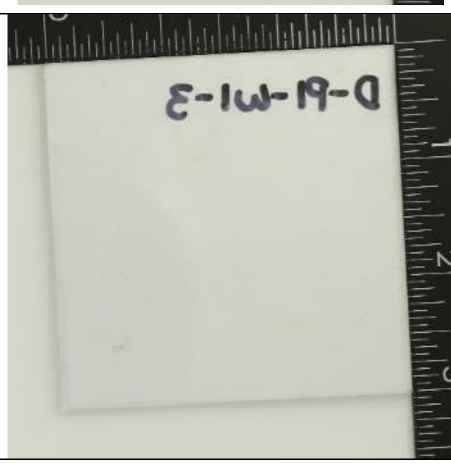
	Pre-Conditioning	Post-Conditioning
D-P1-W1-1		
D-P1-W1-2		
D-P1-W1-3		

Table E- 5. Test photos for D-P1-W2-X – Lexan™ 9600 – Calla® 1452 – wiping method

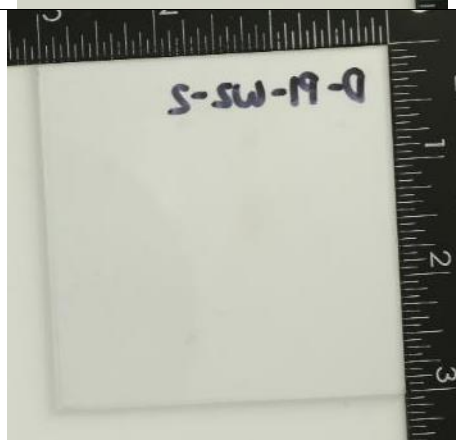
	Pre-Conditioning	Post-Conditioning
D-P1-W2-1		
D-P1-W2-2		
D-P1-W2-3		

Table E- 6. Test photos for D-P1-W3-X – Lexan™ 9600 – Sani-Code EX3 – wiping method

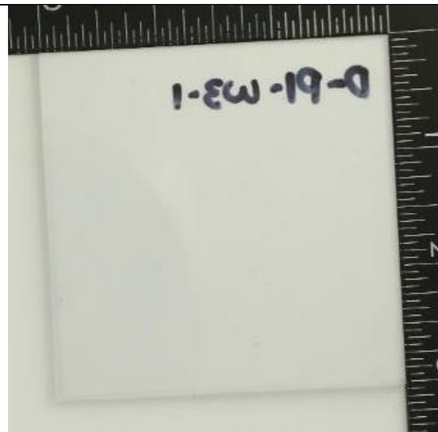
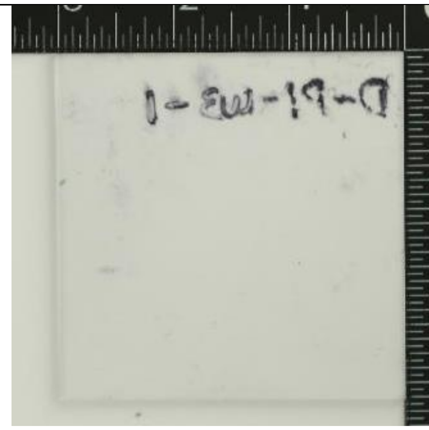
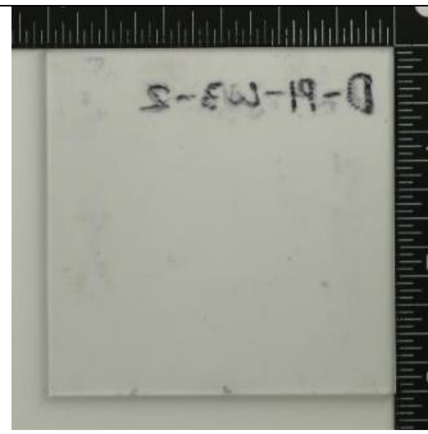
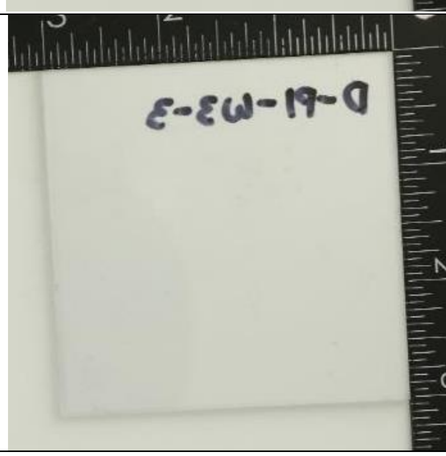
	Pre-Conditioning	Post-Conditioning
D-P1-W3-1		
D-P1-W3-2		
D-P1-W3-3		

Table E- 7. Test photos for D-P1-W4-X – Lexan™ 9600 – PREempt™ RTU – wiping method

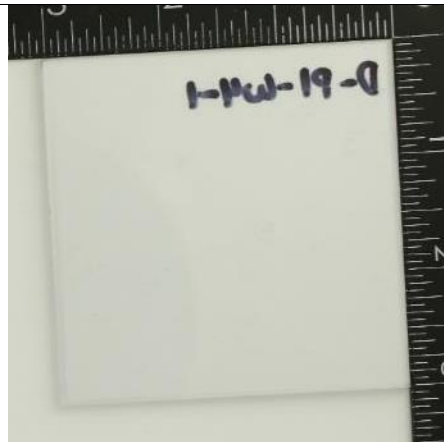
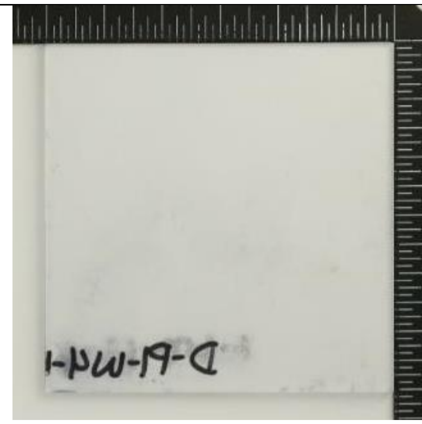
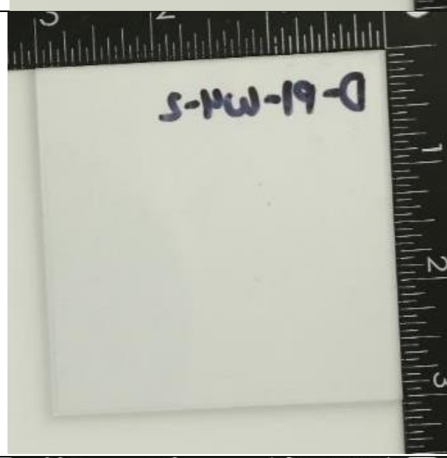
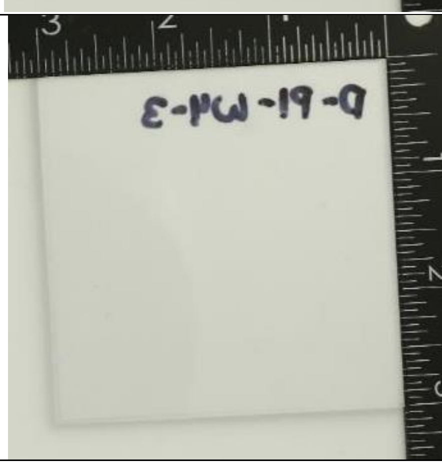
	Pre-Conditioning	Post-Conditioning
D-P1-W4-1		
D-P1-W4-2		
D-P1-W4-3		

Table E- 8. Test photos for D-P1-W5-X – Lexan™ 9600 – Bactrokill + - wiping method

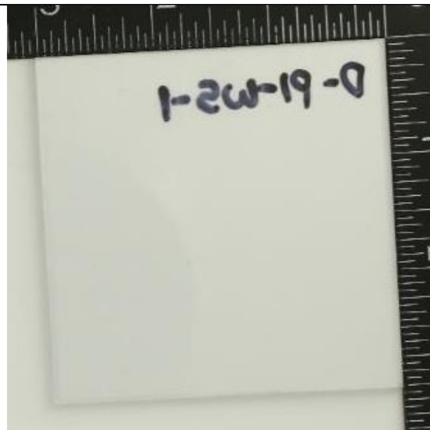
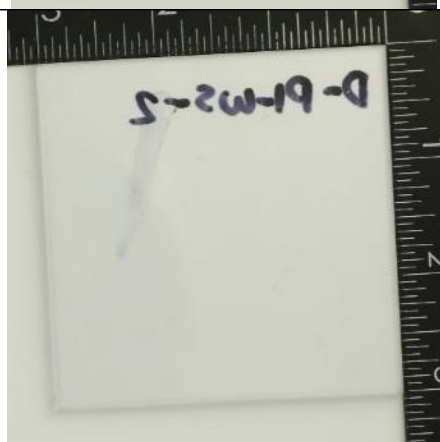
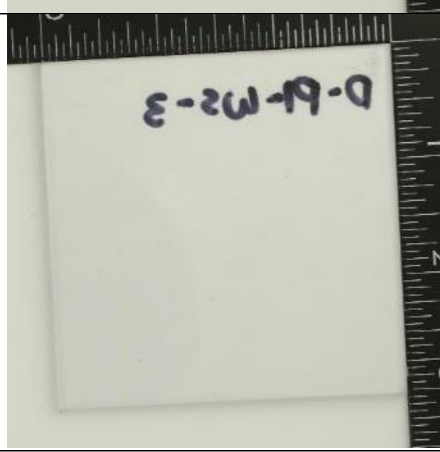
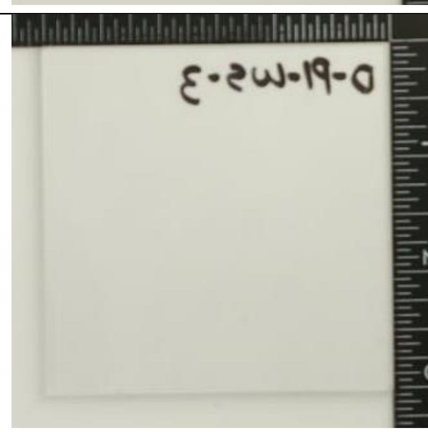
	Pre-Conditioning	**Post-Conditioning**
D-P1-W5-1		
D-P1-W5-2		
D-P1-W5-3		

Table E- 9. Test photos for D-P1-U1-X – Lexan™ 9600 – 222 nm for eight years – UV-C method

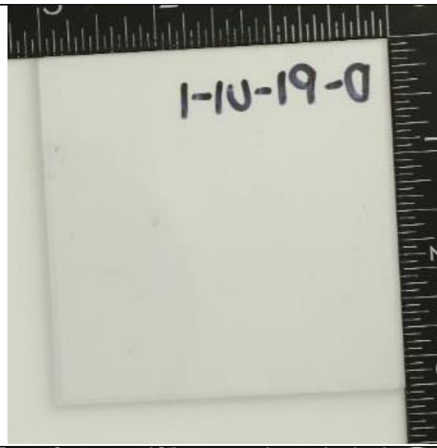
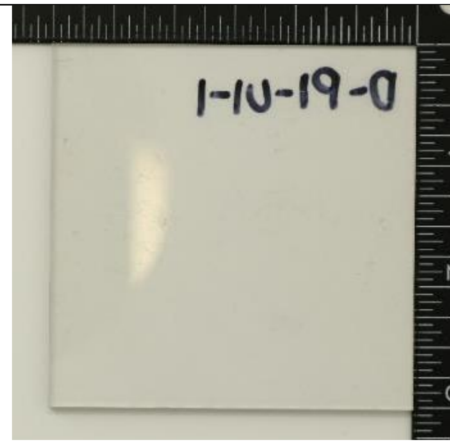
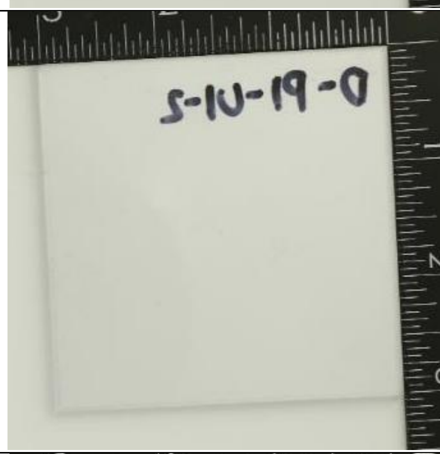
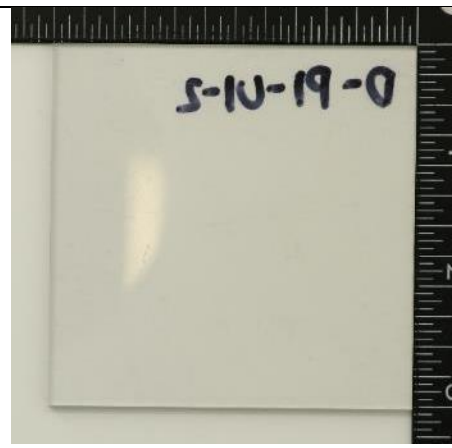
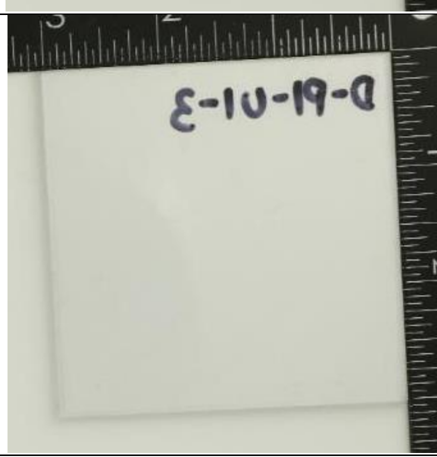
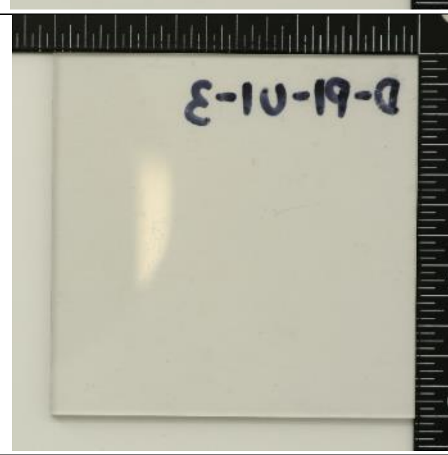
	Pre-Conditioning	**Post-Conditioning**
D-P1-U1-1		
D-P1-U1-2		
D-P1-U1-3		

Table E- 10. Test photos for D-P1-U2-X – Lexan™ 9600 – 254 nm for one year – UV-C method

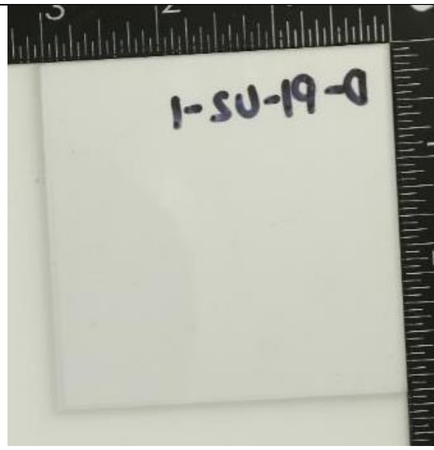
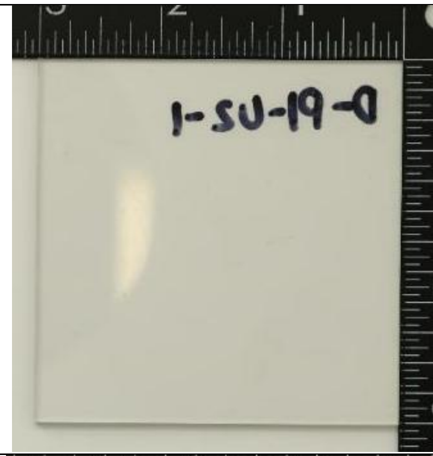
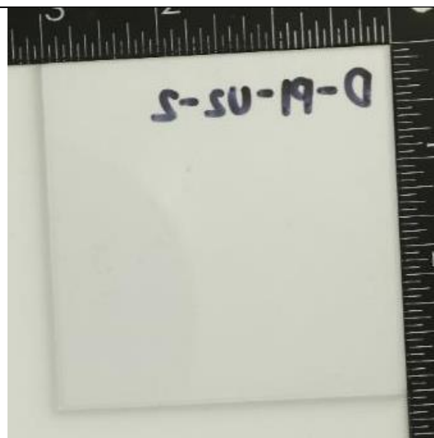
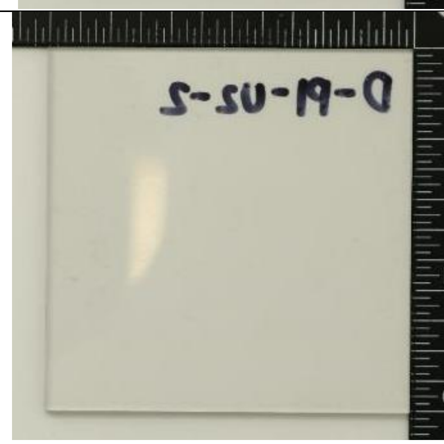
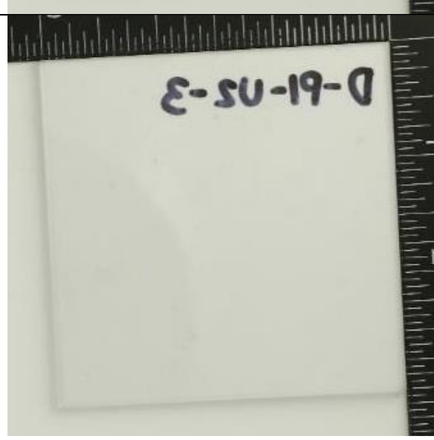
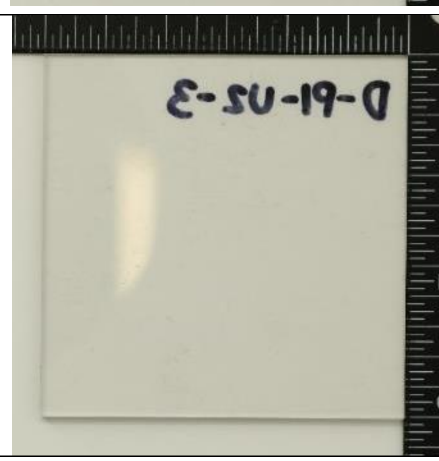
	Pre-Conditioning	Post-Conditioning
D-P1-U2-1		
D-P1-U2-2		
D-P1-U2-3		

Table E- 11. Test photos for D-P1-U3-X – Lexan™ 9600 – 280 nm for eight years – UV-C method

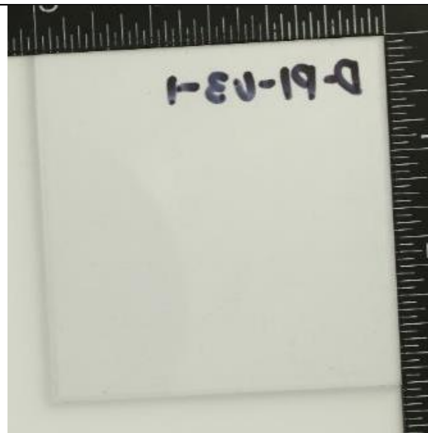
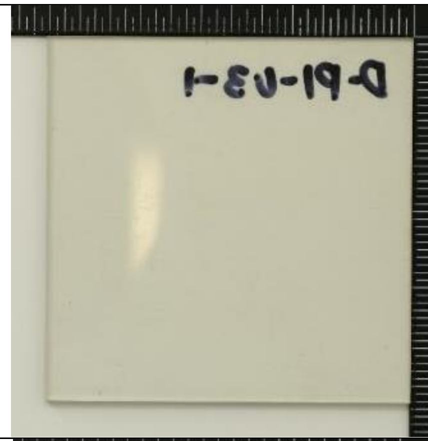
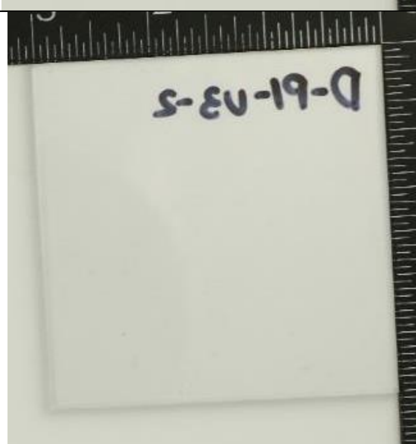
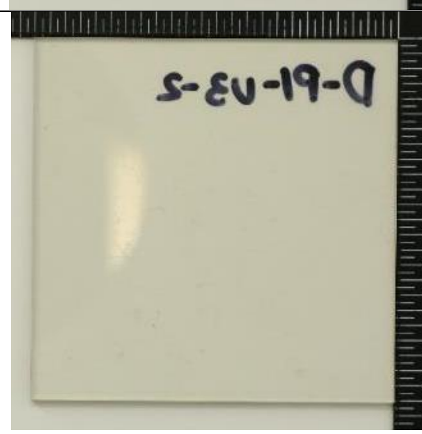
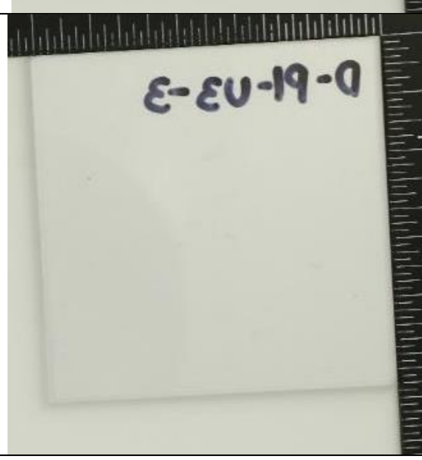
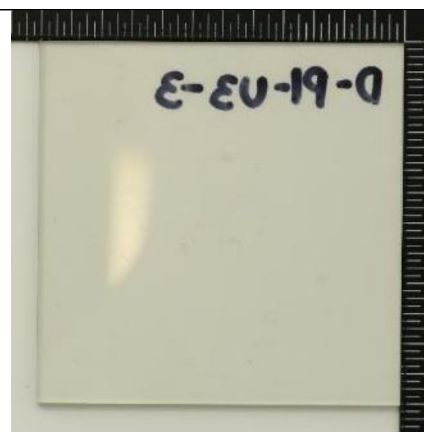
	Pre-Conditioning	**Post-Conditioning**
D-P1-U3-1		
D-P1-U3-2		
D-P1-U3-3		

Table E- 12. Test photos for D-P1-U4-X – Lexan™ 9600 – 222 nm for four years – UV-C method

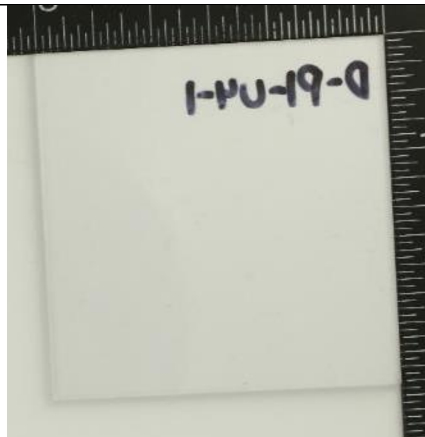
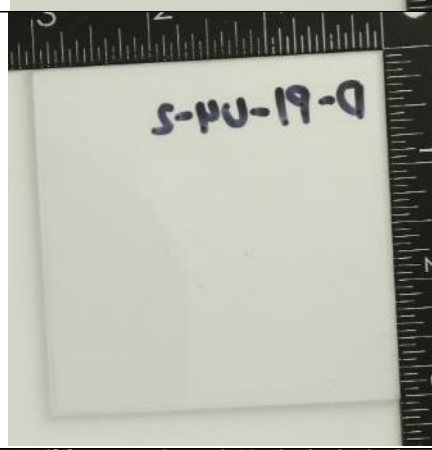
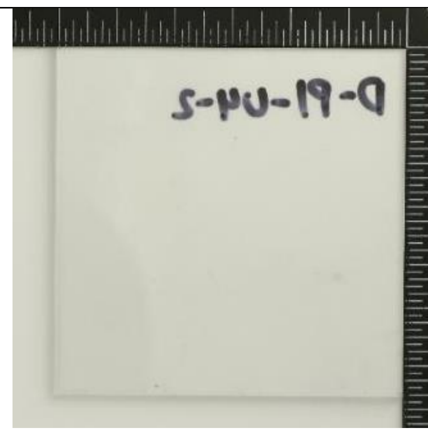
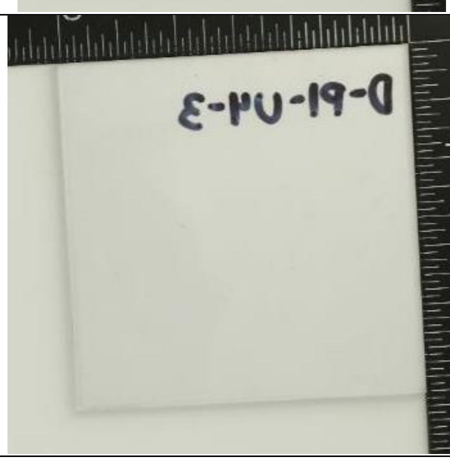
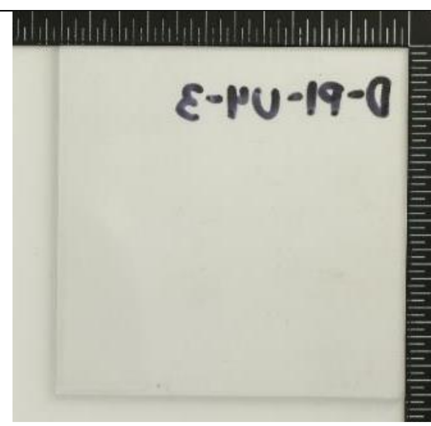
	Pre-Conditioning	Post-Conditioning
D-P1-U4-1		
D-P1-U4-2		
D-P1-U4-3		

Table E- 13. Test photos for D-P1-U5-X – Lexan™ 9600 – 254 nm for four years – UV-C method

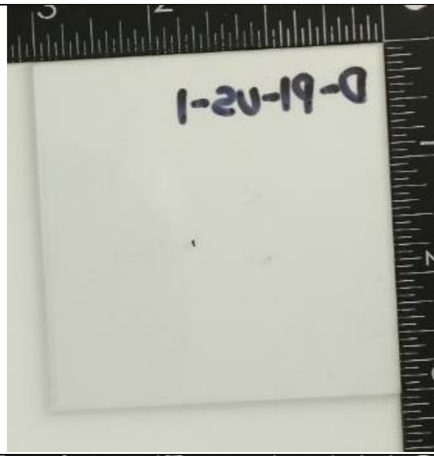
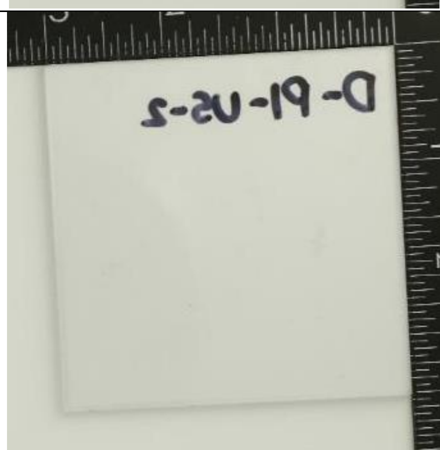
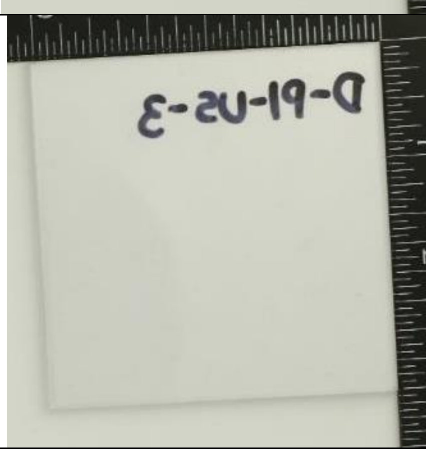
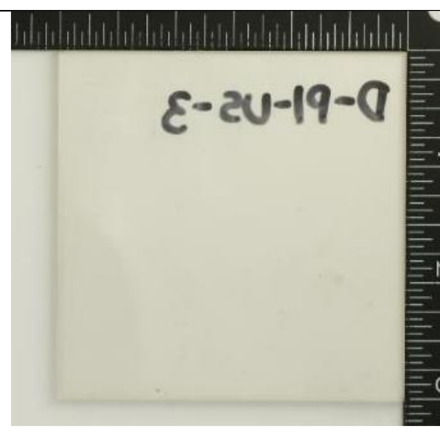
	Pre-Conditioning	Post-Conditioning
D-P1-U5-1		
D-P1-U5-2		
D-P1-U5-3		

Table E- 14. Test photos for D-P1-U6-X – Lexan™ 9600 – 280 nm for four years – UV-C method

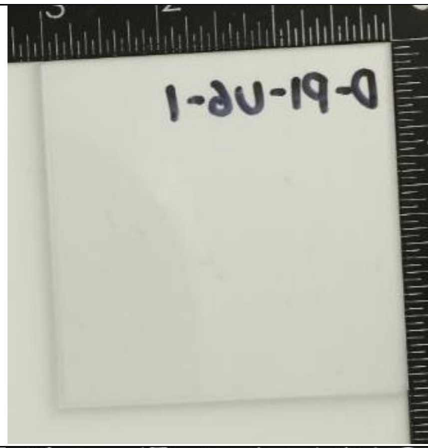
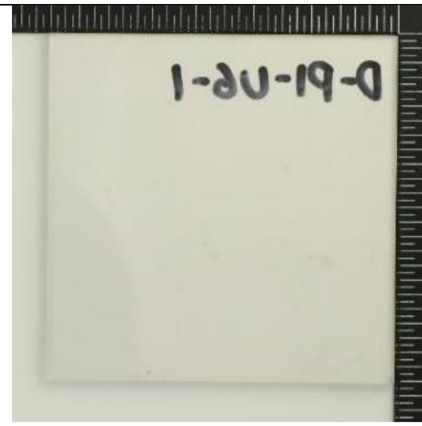
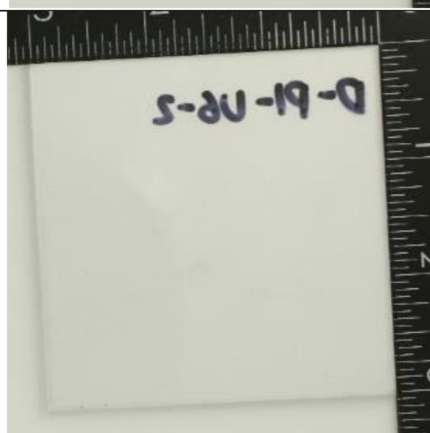
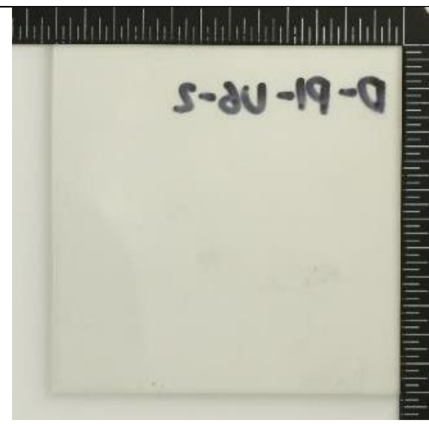
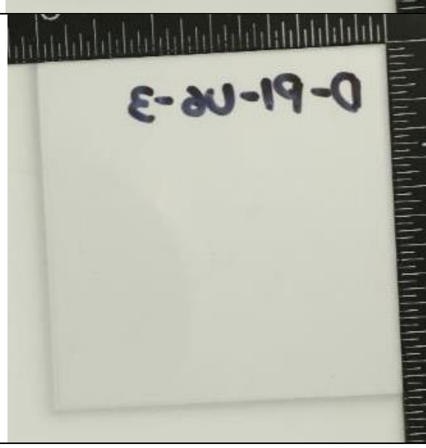
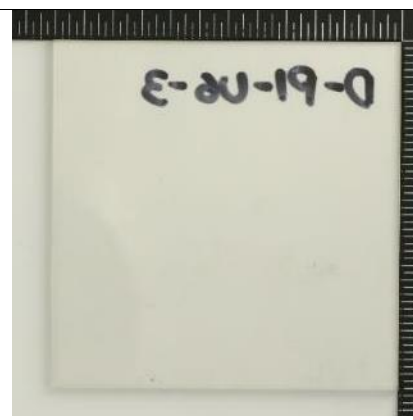
	Pre-Conditioning	**Post-Conditioning**
D-P1-U6-1		
D-P1-U6-2		
D-P1-U6-3		

Table E- 15. Test photos for D-P2-C-X – poly II acrylic – control

	Check-in
D-P2-C-1	
D-P2-C-2	
D-P2-C-3	

Table E- 16. Test photos for D-P2-W1-X – poly II acrylic – 70% IPA – wiping method

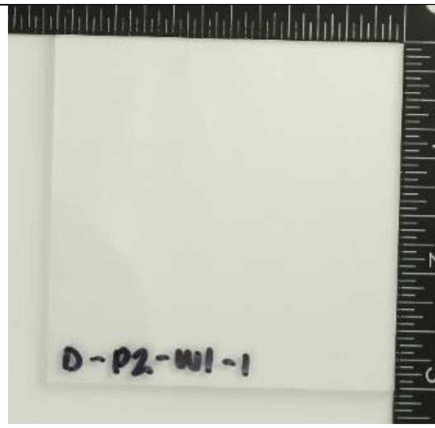
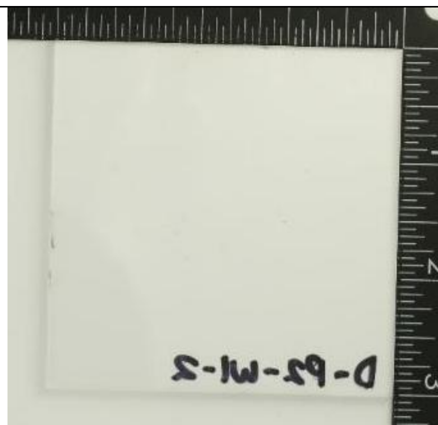
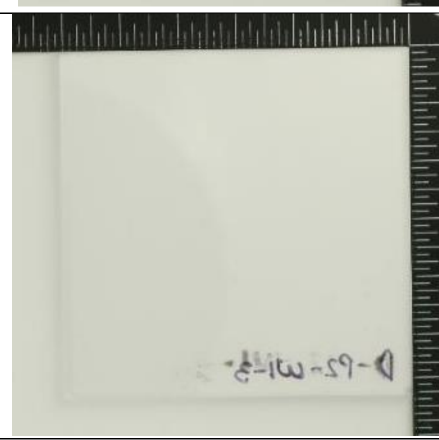
	Pre-Conditioning	Post-Conditioning
D-P2-W1-1		
D-P2-W1-2		
D-P2-W1-3		

Table E- 17. Test photos for D-P2-W2-X – poly II acrylic – Calla® 1452 – wiping method

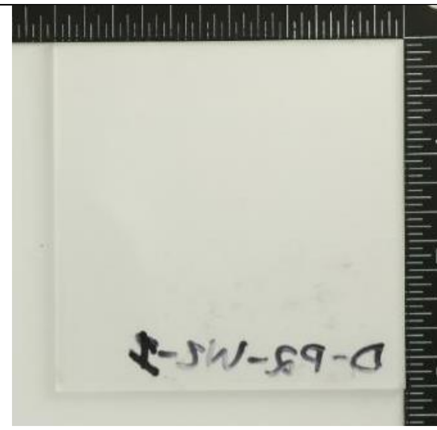
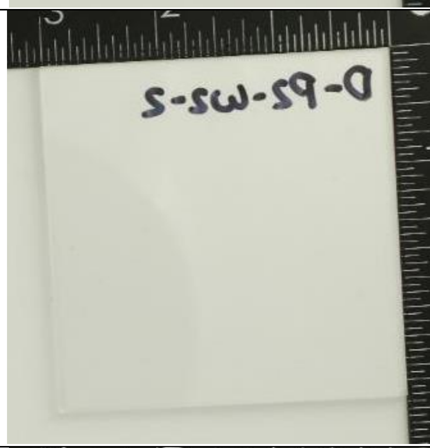
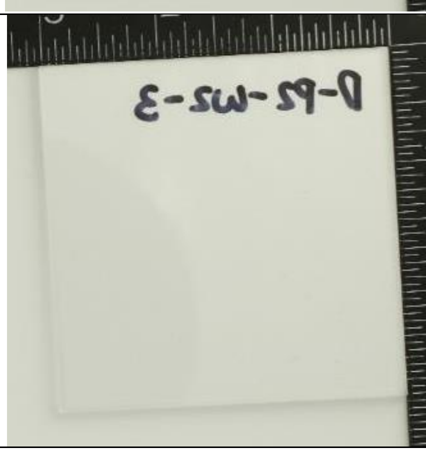
	Pre-Conditioning	Post-Conditioning
D-P2-W2-1		
D-P2-W2-2		
D-P2-W2-3		

Table E- 18. Test photos for D-P2-W3-X – poly II acrylic – Sani-Cide EX3 – wiping method

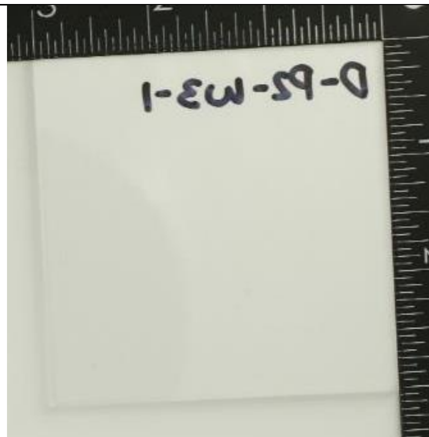
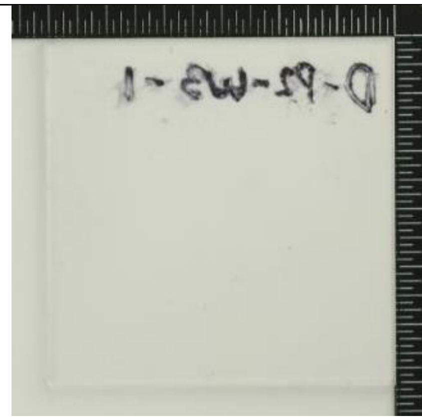
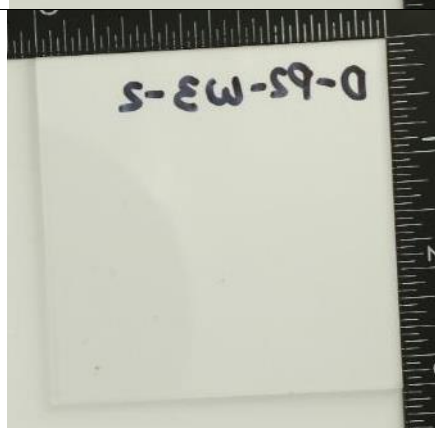
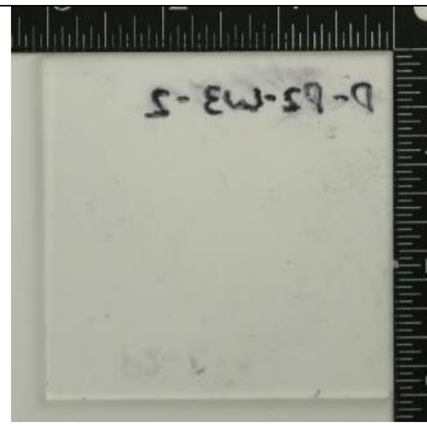
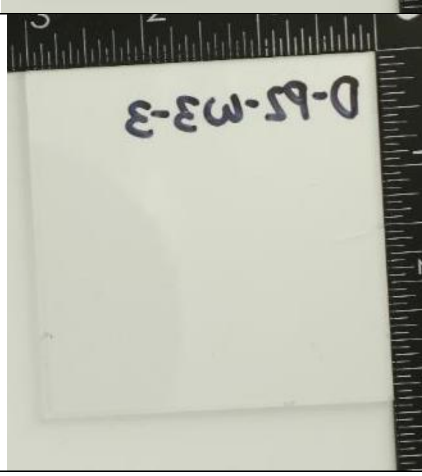
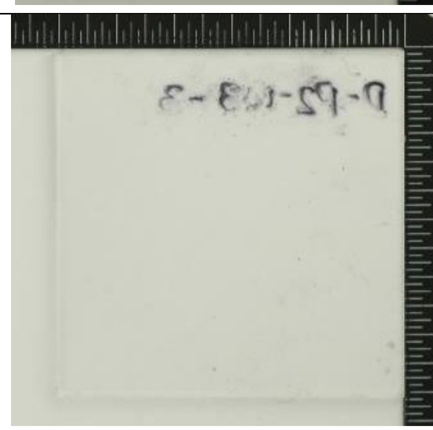
	Pre-Conditioning	**Post-Conditioning**
D-P2-W3-1		
D-P2-W3-2		
D-P2-W3-3		

Table E- 19. Test photos for D-P2-W4-X – poly II acrylic – PREempt™ RTU – wiping method

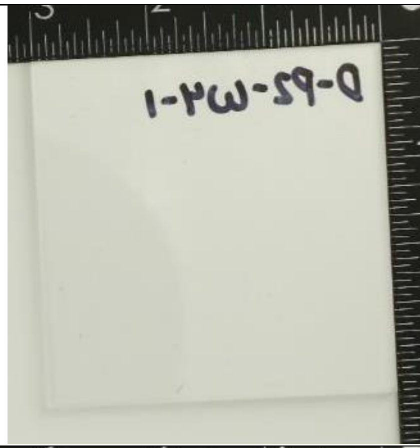
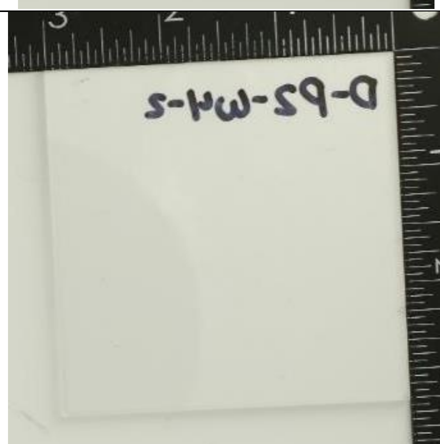
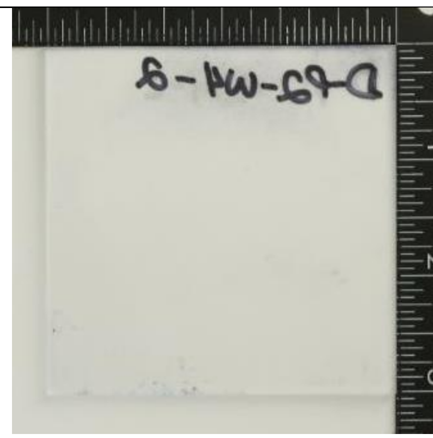
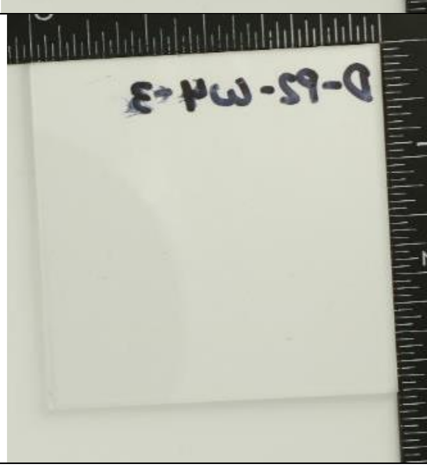
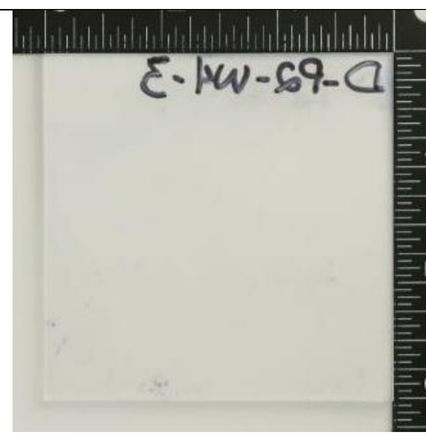
	Pre-Conditioning	Post-Conditioning
D-P2-W4-1		
D-P2-W4-2		
D-P2-W4-3		

Table E- 20. Test photos for D-P2-W5-X – poly II acrylic – Bactrokill + – wiping method

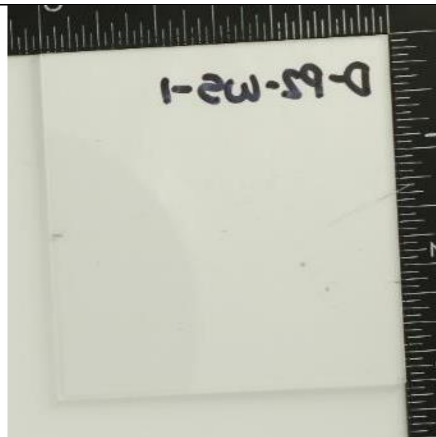
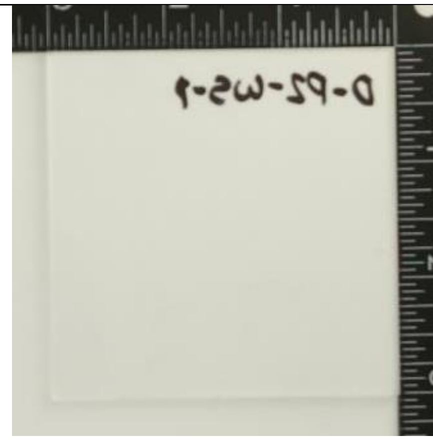
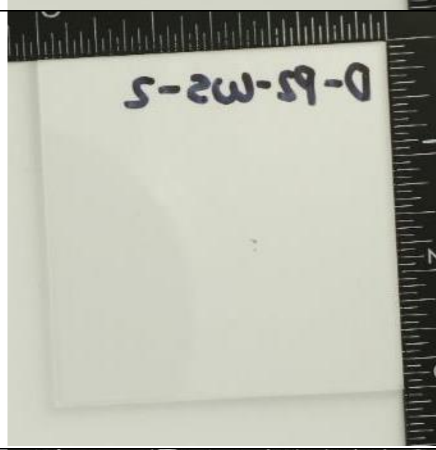
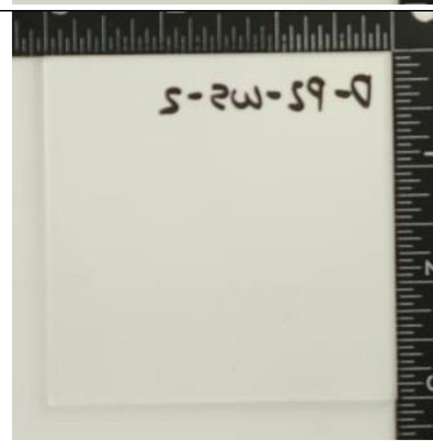
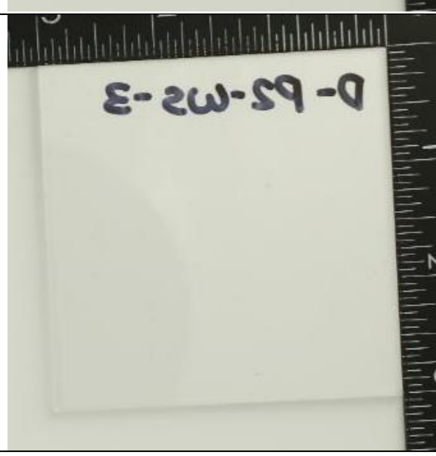
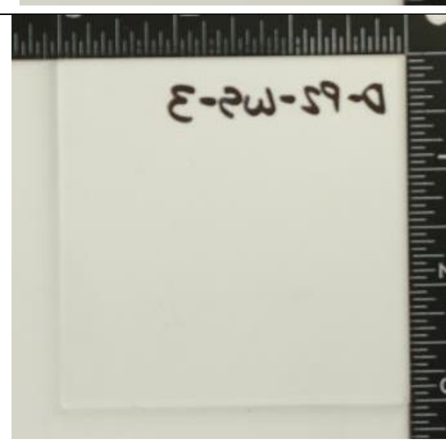
	Pre-Conditioning	Post-Conditioning
D-P2-W5-1		
D-P2-W5-2		
D-P2-W5-3		

Table E- 21. Test photos for D-P2-U1-X – 222 nm for eight years – UV-C method

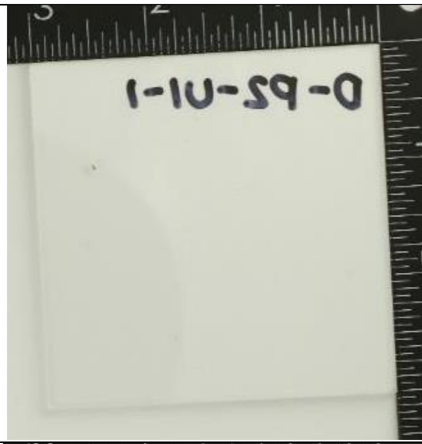
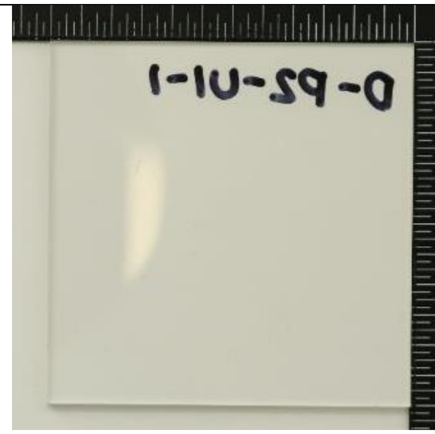
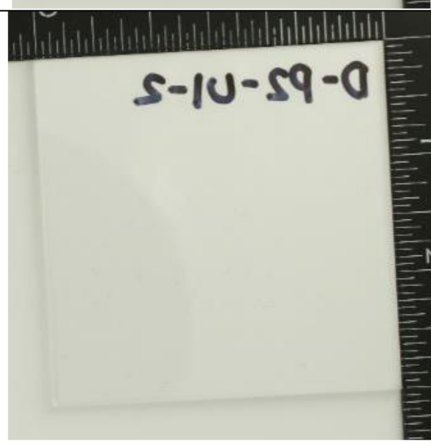
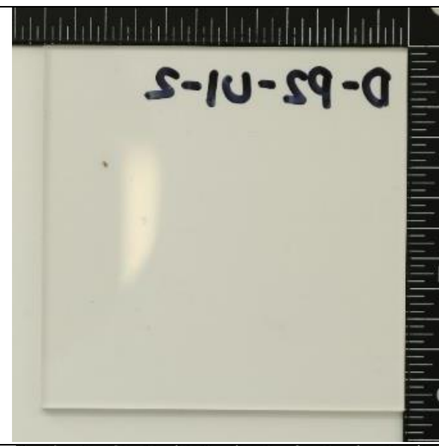
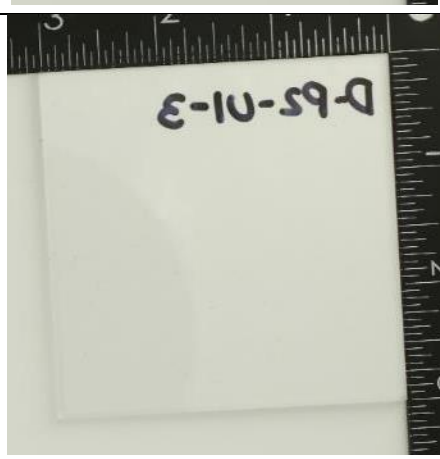
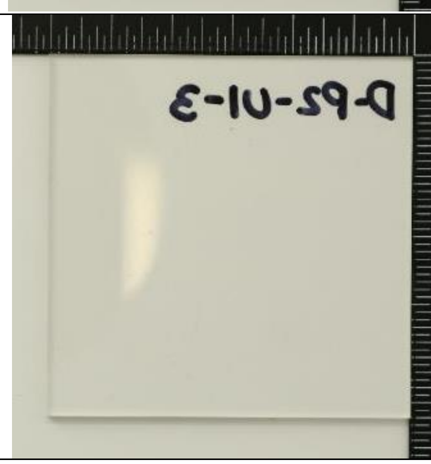
	Pre-Conditioning	**Post-Conditioning**
D-P2-U1-1		
D-P2-U1-2		
D-P2-U1-3		

Table E- 22 Test photos for D-P2-U2-X – poly II acrylic – 254 nm for one year – UV-C method

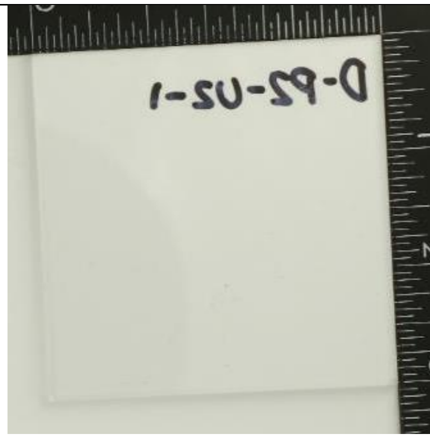
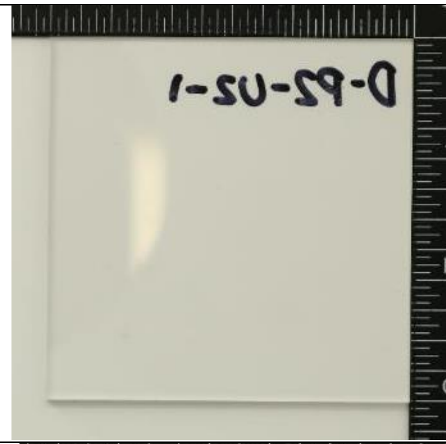
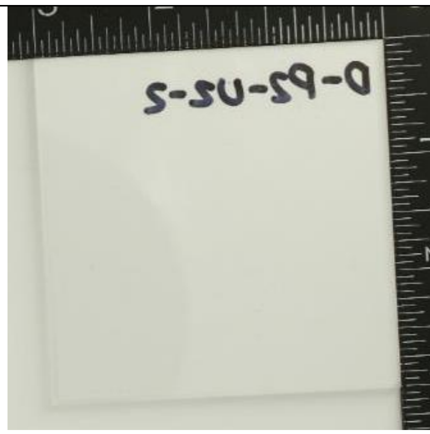
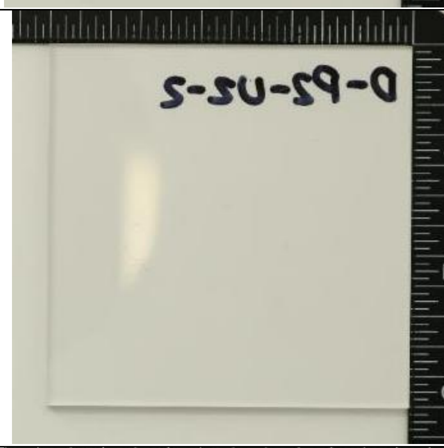
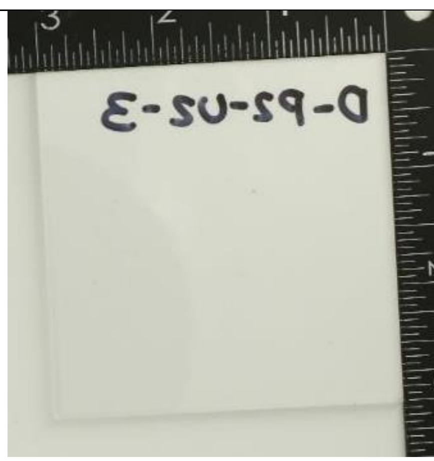
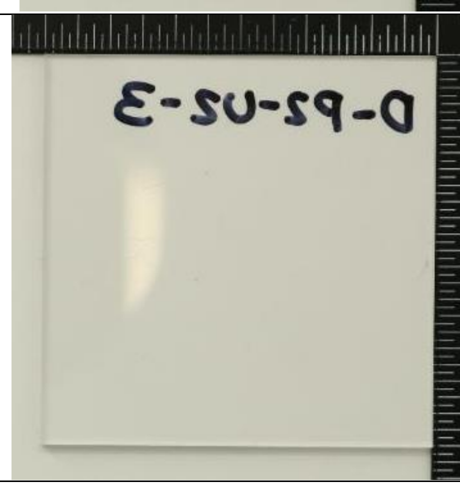
	Pre-Conditioning	Post-Conditioning
D-P2-U2-1		
D-P2-U2-2		
D-P2-U2-3		

Table E- 23. Test photos for D-P2-U3-X – poly II acrylic – 280 nm for one year – UV-C method

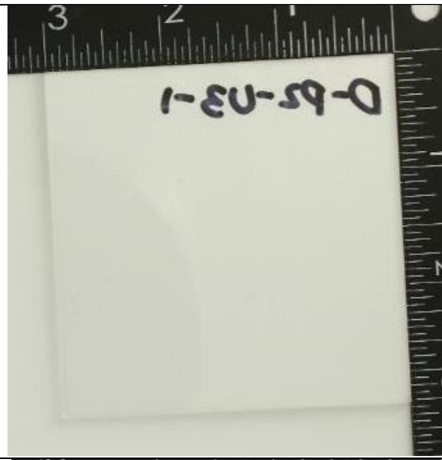
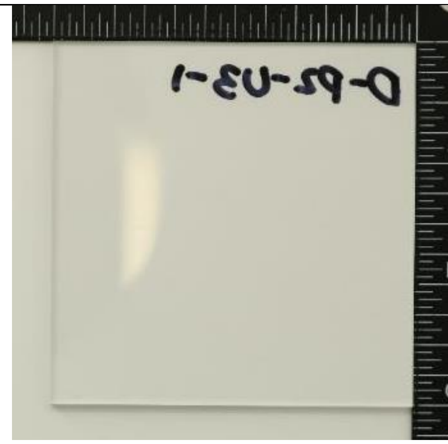
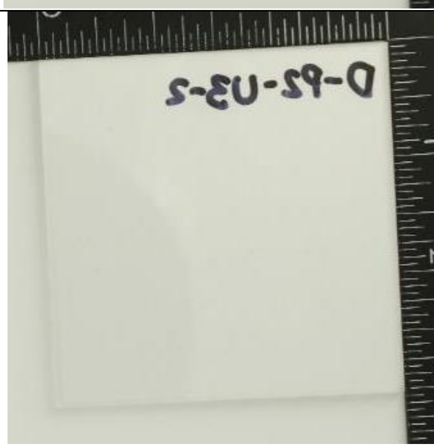
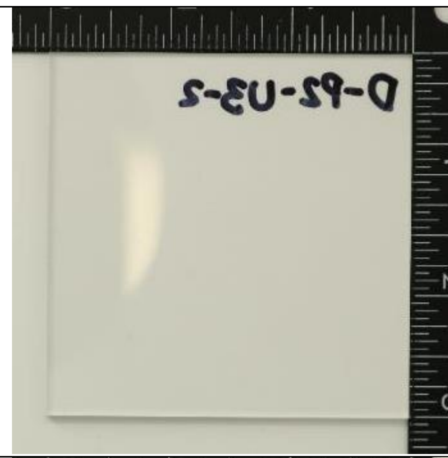
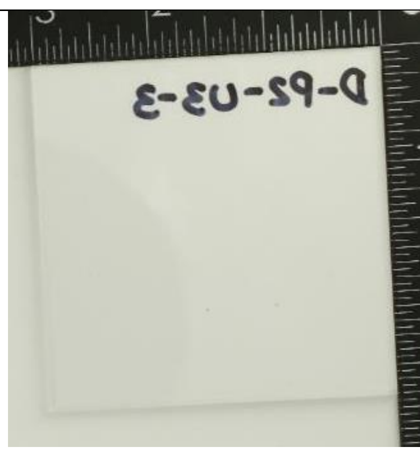
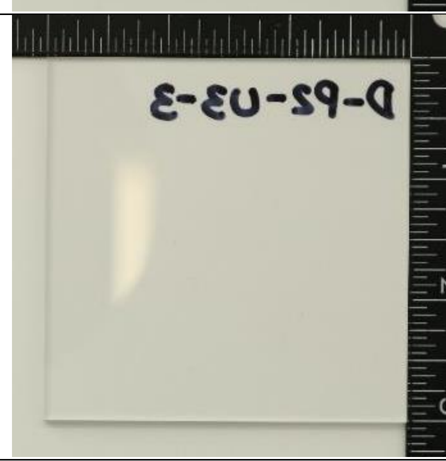
	Pre-Conditioning	Post-Conditioning
D-P2-U3-1		
D-P2-U3-2		
D-P2-U3-3		

Table E- 24. Test photos for D-P2-U4-X – poly II acrylic – 222 nm for four years – UV-C method

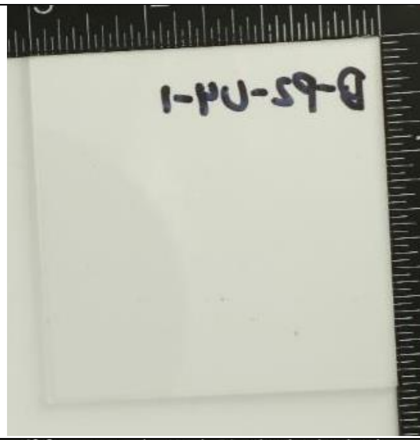
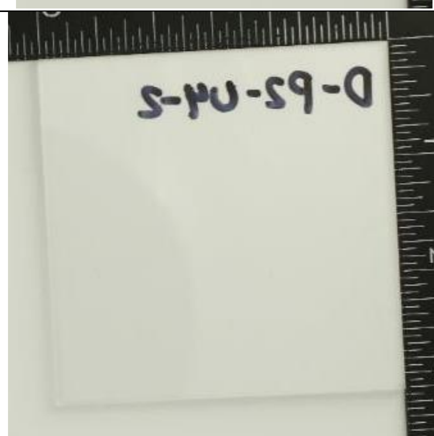
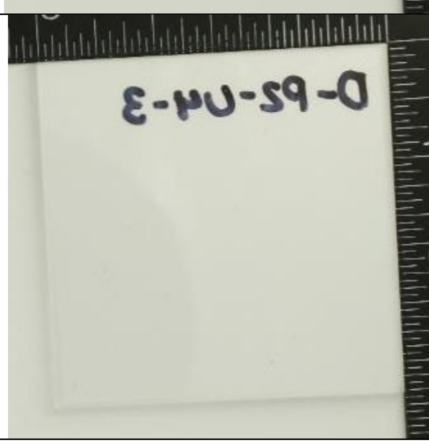
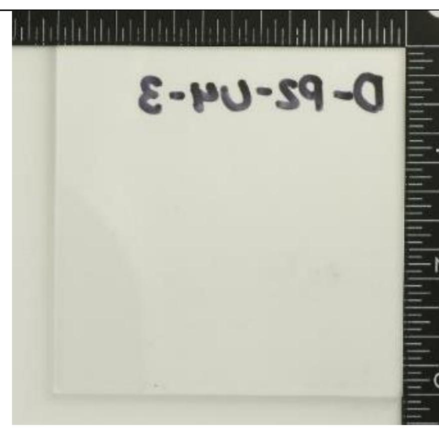
	Pre-Conditioning	**Post-Conditioning**
D-P2-U4-1		
D-P2-U4-2		
D-P2-U4-3		

Table E- 25. Test photos for D-P2-U5-X – poly II acrylic – 254 nm for four years – UV-C method

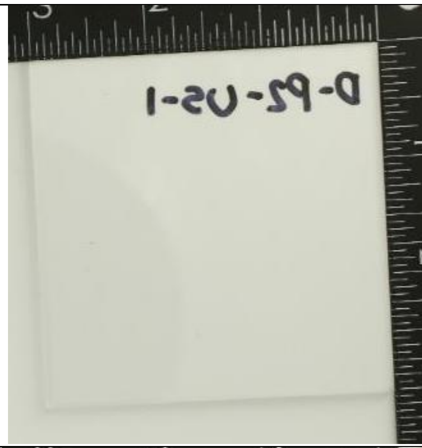
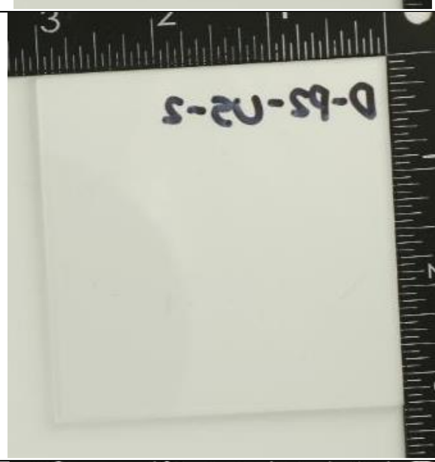
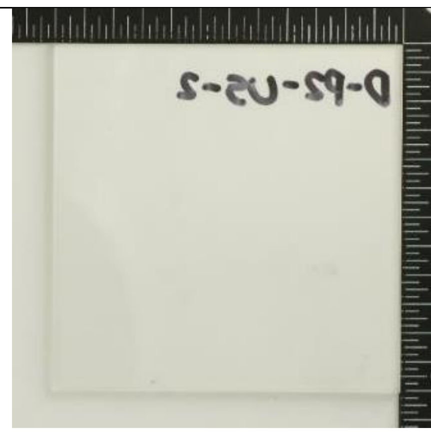
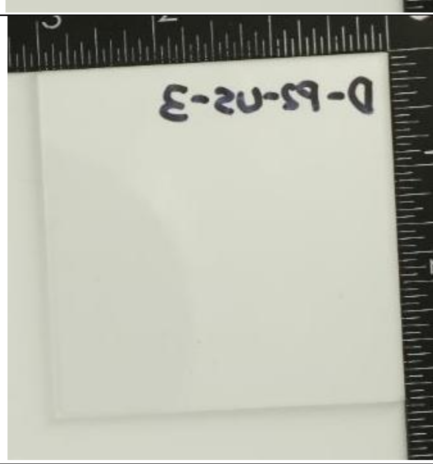
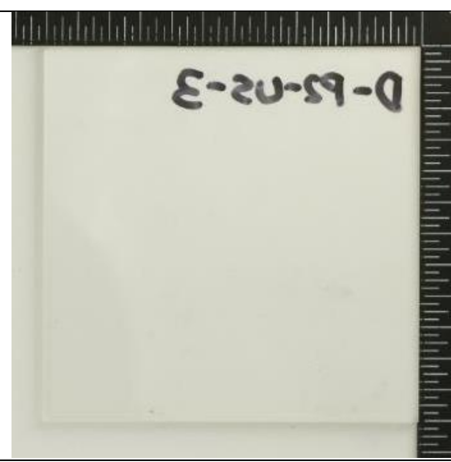
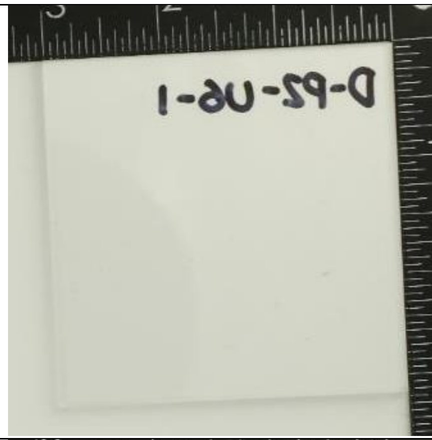
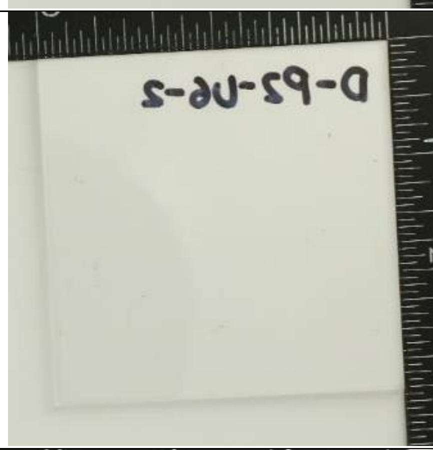
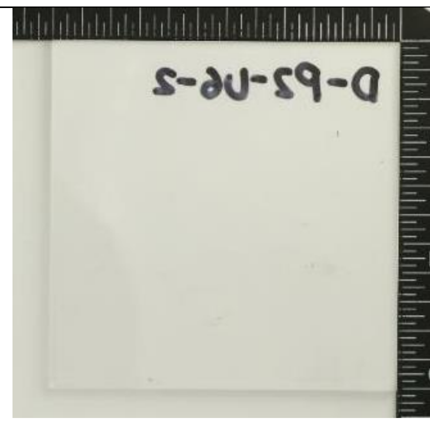
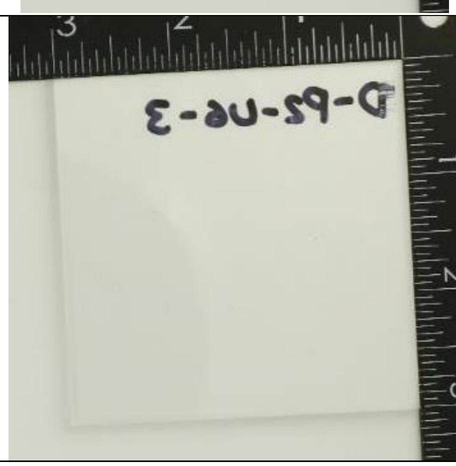
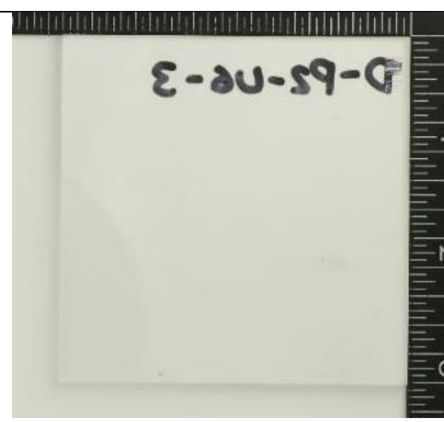
	Pre-Conditioning	**Post-Conditioning**
D-P2-U5-1		
D-P2-U5-2		
D-P2-U5-3		

Table E- 26. Test photos for D-P2-U6-X – poly II acrylic – 280 nm for four years – UV-C method

	Pre-Conditioning	**Post-Conditioning**
D-P2-U6-1		
D-P2-U6-2		
D-P2-U6-3		

F Contact angle test data and photos

Table F- 1. Contact angle test data – antireflective/antiglare/oleophobic coating A

Test Article ID	Drop 1		Drop 2		Drop 3		Total Average	Oleophobicity
	Theta Left	**Theta Right**	**Theta Left**	**Theta Right**	**Theta Left**	**Theta Right**		
LC-C1-C-1	87.70	86.70	89.70	86.90	84.80	85.70	86.92	Oleophobic
LC-C1-W1-1	102.60	97.30	106.80	107.30	101.80	108.50	101.89	Oleophilic
LC-C1-W1-2	95.90	108.40	111.10	105.50	97.80	99.00		
LC-C1-W1-3	99.40	92.70	100.70	99.40	101.00	98.90		
LC-C1-W2-1	112.30	82.80	86.70	85.50	85.60	85.40	86.87	Oleophobic
LC-C1-W2-2	81.80	81.20	84.20	84.50	89.40	87.40		
LC-C1-W2-3	112.00	80.60	85.10	81.90	84.90	84.80		
C1-EXTRA-1	87.70	84.10	84.00	83.50	84.70	84.80		
LC-C1-W3-1	97.20	98.40	88.50	85.70	88.40	87.40	92.49	Oleophilic
LC-C1-W3-2	84.00	83.80	89.30	89.80	90.20	88.60		
LC-C1-W3-3	103.90	104.50	98.70	93.90	100.20	92.40		
LC-C1-W4-1	87.20	85.30	83.80	83.90	90.40	89.10	90.03	Oleophilic
LC-C1-W4-2	89.50	88.00	94.40	93.10	94.70	95.00		
LC-C1-W4-3	91.80	87.80	93.20	93.40	88.50	91.40		
LC-C1-W5-1	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Oleophilic
LC-C1-W5-2	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured		
LC-C1-W5-3	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured		

Test Article ID	Drop 1		Drop 2		Drop 3		Total Average	Oleophobicity
	Theta Left	Theta Right	Theta Left	Theta Right	Theta Left	Theta Right		
LC-C1-U1-1	84.80	82.70	89.60	86.00	84.30	81.70	88.07	Oleophobic
LC-C1-U1-2	90.10	88.50	95.80	93.10	94.60	90.30		
LC-C1-U1-3	84.00	84.70	93.00	87.80	87.00	87.20		
LC-C1-U2-1	88.90	86.00	92.30	88.00	85.60	84.80	90.20	Oleophilic
LC-C1-U2-2	97.20	94.30	88.30	87.00	95.40	89.20		
LC-C1-U2-3	95.10	94.80	91.20	86.60	91.00	87.90		
LC-C1-U3-1	91.00	91.20	92.80	89.80	88.00	87.40	87.50	Oleophobic
LC-C1-U3-2	84.10	81.60	86.40	84.50	93.20	92.10		
LC-C1-U3-3	84.80	84.90	86.90	83.60	88.30	84.40		
LC-C1-U4-1	86.70	86.80	87.00	87.00	88.20	87.90	86.91	Oleophobic
LC-C1-U4-2	88.30	88.50	87.90	89.10	83.10	82.90		
LC-C1-U4-3	87.20	88.50	84.60	86.30	87.20	87.10		
LC-C1-U5-1	82.30	83.80	87.80	86.50	86.40	85.70	85.14	Oleophobic
LC-C1-U5-2	83.50	81.60	82.70	82.20	81.90	81.70		
LC-C1-U5-3	90.30	87.00	88.80	85.50	88.00	86.90		
LC-C1-U6-1	85.70	87.70	84.00	82.50	80.30	81.80	84.21	Oleophobic
LC-C1-U6-2	80.70	80.30	84.70	84.90	82.50	82.20		
LC-C1-U6-3	84.60	85.10	87.40	86.20	86.80	88.30		

Table F- 2. Contact angle test data – oleophobic coating B

Test Article ID	Drop 1		Drop 2		Drop 3		Total Average	Oleophobicity
	Theta Left	Theta Right	Theta Left	Theta Right	Theta Left	Theta Right		
LC-C2-C-1	87.80	85.50	84.70	84.60	83.50	85.90	85.33	Oleophobic
LC-C2-W1-1	86.30	90.10	92.10	95.90	94.90	93.20	90.97	Oleophilic
LC-C2-W1-2	84.70	81.30	91.60	91.50	92.60	92.90		
LC-C2-W1-3	89.80	91.00	89.60	95.60	91.30	93.10		
LC-C2-W2-1	83.50	83.50	81.80	81.20	84.00	85.60	82.97	Oleophobic
LC-C2-W2-2	81.20	80.80	86.60	86.40	82.80	83.50		
LC-C2-W2-3	84.30	81.50	80.60	80.90	83.90	81.40		
LC-C2-W3-1	85.20	85.60	88.90	85.90	92.30	92.70	91.29	Oleophilic
LC-C2-W3-2	96.10	88.60	93.60	88.00	98.90	94.00		
LC-C2-W3-3	99.40	98.80	90.30	91.00	87.70	86.30		
LC-C2-W4-1	83.70	81.70	85.50	84.30	89.30	86.00	83.90	Oleophobic
LC-C2-W4-2	85.60	80.00	87.00	82.60	88.50	83.20		
LC-C2-W4-3	84.40	81.60	82.30	80.50	82.60	81.40		
LC-C2-W5-1	84.50	81.70	88.10	86.10	84.30	83.50	83.71	Oleophobic
LC-C2-W5-2	85.60	83.90	84.70	82.20	82.80	84.60		
LC-C2-W5-3	81.30	80.40	80.80	81.10	85.70	85.40		
LC-C2-U1-1	81.90	82.80	85.40	82.20	86.80	85.30	83.44	Oleophobic
LC-C2-U1-2	80.60	79.80	83.80	81.60	79.80	79.00		
LC-C2-U1-3	92.30	89.40	86.90	81.20	82.50	80.60		
LC-C2-U2-1	90.50	87.10	83.30	80.60	82.40	78.90	81.60	Oleophobic
LC-C2-U2-2	84.90	84.80	81.30	80.80	77.30	75.80		

Test Article ID	Drop 1		Drop 2		Drop 3		Total Average	Oleophobicity
	Theta Left	Theta Right	Theta Left	Theta Right	Theta Left	Theta Right		
LC-C2-U2-3	78.70	79.70	81.90	81.70	82.40	76.70		
LC-C2-U3-1	84.50	80.80	86.00	83.90	78.30	78.60	82.55	Oleophobic
LC-C2-U3-2	86.90	81.30	80.50	78.40	84.90	84.00		
LC-C2-U3-3	83.60	81.90	83.10	78.30	85.50	85.40		
LC-C2-U4-1	77.70	78.10	78.30	75.80	77.50	77.10	79.21	Oleophobic
LC-C2-U4-2	81.50	82.50	81.70	88.00	81.50	81.60		
LC-C2-U4-3	80.10	79.60	72.90	74.60	78.20	79.00		
LC-C2-U5-1	78.10	77.30	78.40	79.80	73.60	73.50	79.55	Oleophobic
LC-C2-U5-2	77.70	74.00	77.70	78.90	81.30	81.30		
LC-C2-U5-3	81.70	87.80	83.50	83.60	82.50	81.20		
LC-C2-U6-1	89.40	85.80	78.20	79.40	79.30	81.90	82.13	Oleophobic
LC-C2-U6-2	78.30	85.70	80.20	80.10	78.70	78.60		
LC-C2-U6-3	83.30	87.00	85.80	85.10	82.40	79.20		

Table F- 3. Contact angle test data – oleophobic coating C

Test Article ID	Drop 1		Drop 2		Drop 3		Total Average	Oleophobicity
	Theta Left	Theta Right	Theta Left	Theta Right	Theta Left	Theta Right		
LC-C3-C-1	89.30	93.20	86.90	86.20	90.80	87.30	88.95	Oleophobic
LC-C3-W1-1	89.10	93.10	91.00	87.80	90.60	89.30	87.43	Oleophobic
LC-C3-W1-2	86.90	84.60	88.70	88.50	86.20	83.50		
LC-C3-W1-3	88.50	85.20	86.70	83.40	86.60	84.00		
LC-C3-W2-1	82.20	77.70	85.90	84.60	86.40	84.00	84.23	Oleophobic

Test Article ID	Drop 1		Drop 2		Drop 3		Total Average	Oleophobicity
	Theta Left	Theta Right	Theta Left	Theta Right	Theta Left	Theta Right		
LC-C3-W2-2	84.20	83.60	84.80	83.20	85.70	81.90		
LC-C3-W2-3	86.90	82.60	84.00	83.20	89.60	85.60		
LC-C3-W3-1	91.50	87.20	91.30	89.10	86.00	84.80	86.75	Oleophobic
LC-C3-W3-2	90.50	86.80	84.70	84.40	92.00	86.50		
LC-C3-W3-3	84.60	81.30	81.00	84.40	89.90	85.50		
LC-C3-W4-1	85.60	82.20	83.60	81.60	84.00	82.90	84.00	Oleophobic
LC-C3-W4-2	92.80	83.10	82.80	82.50	88.70	86.90		
LC-C3-W4-3	83.30	78.60	86.20	83.60	81.40	82.20		
LC-C3-W5-1	83.90	82.00	84.10	84.50	84.80	84.80	83.92	Oleophobic
LC-C3-W5-2	83.30	84.50	81.00	81.50	83.90	83.30		
LC-C3-W5-3	85.50	83.40	86.30	88.00	82.70	83.10		
LC-C3-U1-1	85.40	85.30	82.50	83.40	82.00	82.60	81.96	Oleophobic
LC-C3-U1-2	78.90	75.10	85.70	85.90	80.70	81.60		
LC-C3-U1-3	83.00	83.00	80.70	81.40	76.60	81.50		
LC-C3-U2-1	85.80	84.50	78.50	79.90	81.70	80.50	81.61	Oleophobic
LC-C3-U2-2	83.10	82.00	79.40	82.30	81.00	80.60		
LC-C3-U2-3	82.70	83.00	84.70	81.90	78.20	79.20		
LC-C3-U3-1	84.90	82.70	81.40	80.00	74.50	75.60	81.17	Oleophobic
LC-C3-U3-2	83.50	83.70	79.30	77.70	80.70	79.50		
LC-C3-U3-3	84.20	84.80	83.80	82.10	82.30	80.30		
LC-C3-U4-1	79.00	79.90	76.80	77.60	78.10	77.10	79.41	Oleophobic
LC-C3-U4-2	82.90	80.80	78.00	79.00	82.10	79.10		
LC-C3-U4-3	84.10	83.20	76.90	76.40	79.90	78.50		
LC-C3-U5-1	81.70	78.50	77.10	78.90	77.90	77.20	79.84	Oleophobic

Test Article ID	Drop 1		Drop 2		Drop 3		Total Average	Oleophobicity
	Theta Left	Theta Right	Theta Left	Theta Right	Theta Left	Theta Right		
LC-C3-U5-2	77.90	76.20	83.60	81.40	78.90	80.20		
LC-C3-U5-3	81.20	80.50	79.80	81.00	83.00	82.10		
LC-C3-U6-1	81.70	80.80	80.90	77.90	77.70	80.10		
LC-C3-U6-2	81.90	81.40	80.30	79.10	81.30	78.90	80.66	Oleophobic
LC-C3-U6-3	85.10	84.10	82.30	80.80	79.30	78.30		

Table F- 4. Contact angle data – oleophobic coating D

Test Article ID	Drop 1		Drop 2		Drop 3		Total Average	Oleophobicity
	Theta Left	Theta Right	Theta Left	Theta Right	Theta Left	Theta Right		
LC-C4-C-1	82.00	82.10	79.30	81.40	84.60	81.80	81.87	Oleophobic
LC-C4-W1-1	95.70	94.10	93.80	92.90	93.40	89.90		
LC-C4-W1-2	99.20	97.80	94.50	91.30	101.30	92.00	95.29	Oleophilic
LC-C4-W1-3	96.00	97.70	91.70	87.10	105.70	101.10		
LC-C4-W2-1	94.60	91.50	93.30	91.80	105.00	119.30		
LC-C4-W2-2	95.20	97.60	111.80	123.70	123.00	124.00	106.67	Oleophilic
LC-C4-W2-3	94.70	96.60	108.30	116.80	116.40	116.50		
LC-C4-W3-1	94.40	94.60	110.30	111.20	111.20	110.60		
LC-C4-W3-2	100.00	96.00	105.30	101.20	94.60	89.90	101.91	Oleophilic
LC-C4-W3-3	108.40	108.00	97.30	105.30	99.80	96.30		
LC-C4-W4-1	133.20	129.40	139.60	142.60	141.30	134.00		
LC-C4-W4-2	123.20	130.50	127.80	126.00	133.50	138.80	133.36	Oleophilic
LC-C4-W4-3	131.20	128.40	132.80	136.20	136.20	135.80		

Test Article ID	Drop 1		Drop 2		Drop 3		Total Average	Oleophobicity
	Theta Left	Theta Right	Theta Left	Theta Right	Theta Left	Theta Right		
LC-C4-W5-1	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Note Captured	Oleophilic
LC-C4-W5-2	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured		
LC-C4-W5-3	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured		
LC-C4-U1-1	82.90	83.00	81.80	80.80	79.50	79.70	81.76	Oleophobic
LC-C4-U1-2	83.10	80.80	84.40	85.80	82.70	82.10		
LC-C4-U1-3	83.80	83.90	82.30	83.20	75.70	76.20		
LC-C4-U2-1	79.40	76.80	82.30	82.00	81.60	79.50	79.62	Oleophobic
LC-C4-U2-2	83.80	81.30	78.60	78.10	83.50	83.70		
LC-C4-U2-3	75.30	76.10	79.10	75.70	78.70	77.70		
LC-C4-U3-1	79.20	80.60	79.40	80.30	78.10	78.20	77.68	Oleophobic
LC-C4-U3-2	75.90	74.60	79.50	78.40	76.60	76.80		
LC-C4-U3-3	72.30	72.30	77.40	78.00	80.60	80.10		
LC-C4-U4-1	79.50	77.80	82.00	82.10	79.60	81.30	79.07	Oleophobic
LC-C4-U4-2	77.50	76.60	79.80	79.80	77.40	78.30		
LC-C4-U4-3	76.10	75.10	80.40	79.40	80.90	79.80		
LC-C4-U5-1	78.80	80.10	78.10	79.60	78.40	79.90	79.54	Oleophobic
LC-C4-U5-2	76.10	77.80	80.00	80.00	83.10	82.10		
LC-C4-U5-3	80.20	79.80	78.30	79.80	80.40	79.30		
LC-C4-U6-1	77.40	78.30	79.60	79.90	79.00	81.50	79.86	Oleophobic
LC-C4-U6-2	86.90	79.50	80.70	82.50	79.90	79.20		
LC-C4-U6-3	78.90	78.30	77.90	78.90	80.30	78.80		

Table F- 5. Contact angle test data – antireflective/antiglare/conductive/oleophobic coating A

Test Article ID	Drop 1		Drop 2		Drop 3		Total Average	Oleophobicity
	Theta Left	Theta Right	Theta Left	Theta Right	Theta Left	Theta Right		
LC-C5-C-1	89.30	87.80	81.90	81.40	85.40	84.40	85.03	Oleophobic
LC-C5-W1-1	96.20	95.50	95.10	97.60	101.30	101.80	98.67	Oleophilic
LC-C5-W1-2	100.90	95.90	102.80	104.40	99.80	101.10		
LC-C5-W1-3	98.50	94.80	100.90	98.40	97.10	93.90		
LC-C5-W2-1	87.10	88.20	91.10	88.10	94.80	94.00	93.36	Oleophilic
LC-C5-W2-2	97.80	94.10	96.40	98.70	95.00	96.20		
LC-C5-W2-3	97.40	90.60	92.60	92.30	92.90	93.10		
LC-C5-W3-1	97.90	94.30	92.80	89.90	92.40	97.00	93.09	Oleophilic
LC-C5-W3-2	103.90	95.30	85.20	90.30	90.90	93.20		
LC-C5-W3-3	98.10	91.80	97.70	90.00	86.60	88.30		
LC-C5-W4-1	80.90	79.70	85.40	81.90	78.50	76.40	80.42	Oleophobic
LC-C5-W4-2	78.20	77.50	85.70	85.50	79.00	83.50		
LC-C5-W4-3	79.60	79.70	77.00	78.40	79.80	80.80		
LC-C5-W5-1	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	104.72	Oleophilic
LC-C5-W5-2	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured	Data Not Captured		
LC-C5-W5-3	101.70	101.30	102.50	111.70	109.80	101.30		
LC-C5-U1-1	74.80	75.30	82.80	83.70	80.20	81.20	81.01	Oleophobic
LC-C5-U1-2	80.40	80.40	81.40	81.50	81.00	82.00		
LC-C5-U1-3	86.10	86.80	79.50	79.20	82.40	79.50		
LC-C5-U2-1	77.80	78.60	75.70	76.00	81.00	78.20	79.42	Oleophobic

Test Article ID	Drop 1		Drop 2		Drop 3		Total Average	Oleophobicity
	Theta Left	Theta Right	Theta Left	Theta Right	Theta Left	Theta Right		
LC-C5-U2-2	80.50	77.60	84.30	83.00	79.50	80.40		
LC-C5-U2-3	82.40	81.90	79.50	76.20	79.50	77.40		
LC-C5-U3-1	81.10	81.30	81.00	79.50	84.50	84.30	79.19	Oleophobic
LC-C5-U3-2	80.60	81.30	80.90	78.90	81.10	76.90		
LC-C5-U3-3	76.30	76.30	70.60	70.50	81.30	79.00		
LC-C5-U4-1	73.50	75.30	76.00	77.00	75.00	74.50	76.28	Oleophobic
LC-C5-U4-2	77.60	75.90	77.20	75.20	77.50	76.60		
LC-C5-U4-3	76.30	75.80	76.80	77.90	77.50	77.50		
LC-C5-U5-1	82.70	82.60	76.40	77.10	73.10	75.30	76.95	Oleophobic
LC-C5-U5-2	74.30	77.00	74.70	74.70	75.60	77.20	76.95	Oleophobic
LC-C5-U5-3	74.70	74.70	80.10	79.90	77.00	78.00		
LC-C5-U6-1	74.20	73.00	82.20	76.50	76.60	79.90	78.67	Oleophobic
LC-C5-U6-2	74.70	75.90	79.10	77.10	81.80	81.60		
LC-C5-U6-3	81.90	79.90	81.50	81.70	78.80	79.70		

Table F- 6. Test photos for LC-C1-C-X – antireflective/antiglare /oleophobic coating A – control

	Check-in
LC-C1-C-1	

Table F- 7. Test photos for LC-C1-W1-X – antireflective/antiglare/oleophobic coating A – 70% IPA – wiping method

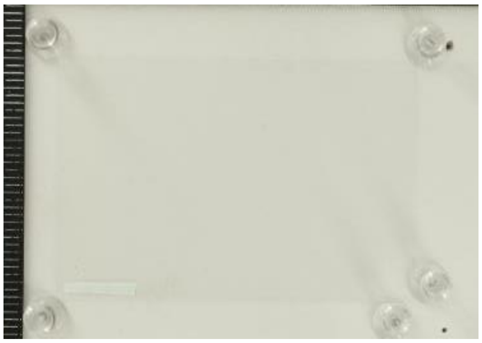
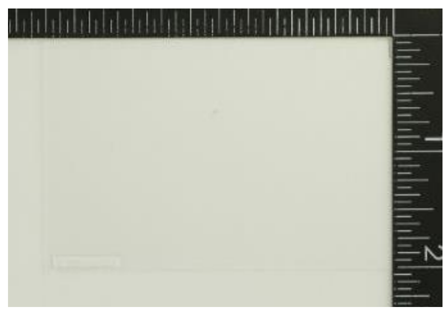
	Pre-Conditioning	Post-Conditioning
LC-C1-W1-1		
LC-C1-W1-2		
LC-C1-W1-3		

Table F- 8. Test photos for LC-C1-W2-X – antireflective/antiglare/oleophobic coating A – Calla® 1452 – wiping method

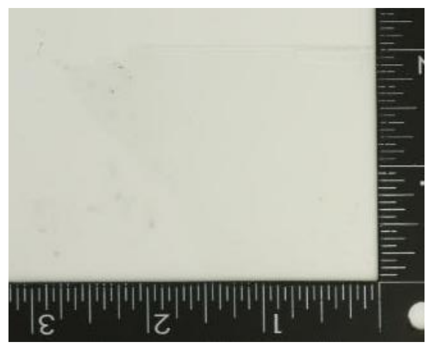
	Pre-Conditioning	Post-Conditioning
LC-C1-W2-1		
LC-C1-W2-2		
LC-C1-W2-3		

Table F- 9. Test photos for LC-C1-W3-X – antireflective/antiglare/oleophobic coating A – Sani-Cide EX3 – wiping method

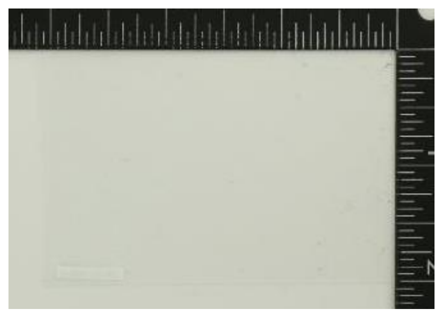
	Pre-Conditioning	Post-Conditioning
LC-C1-W3-1		
LC-C1-W3-2		
LC-C1-W3-3		

Table F- 10. Test photos for LC-C1-W4-X – antireflective/antiglare/oleophobic coating A – PREempt™ RTU – wiping method

	Pre-Conditioning	**Post-Conditioning**
LC-C1-W4-1		
LC-C1-W4-2		
LC-C1-W4-3		

Table F- 11. Test photos for LC-C1-W5-X – antireflective/antiglare/oleophobic coating A – Bactrokill + – wiping method

	Pre-Conditioning	Post-Conditioning
LC-C1-W5-1		
LC-C1-W5-2		
LC-C1-W5-3		

Table F- 12. Test photos for LC-C1-U1-X – antireflective/antiglare/oleophobic coating A – 222 nm for eight years – UV-C method

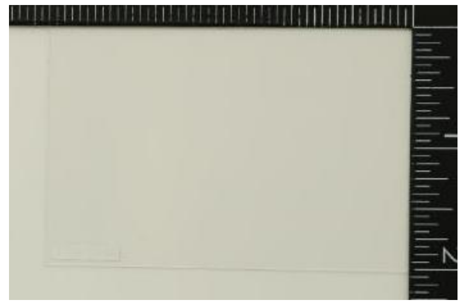
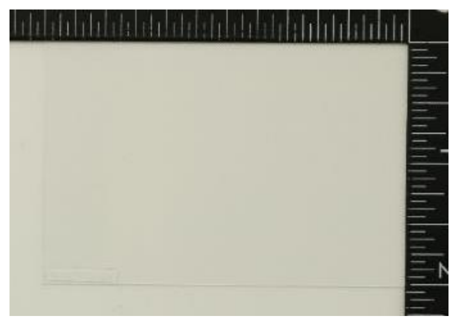
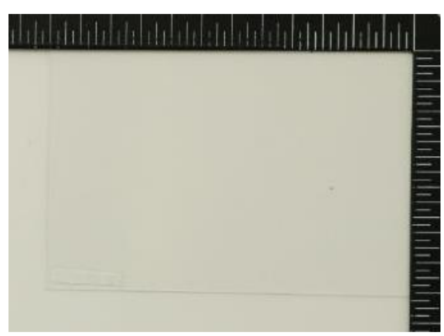
	Pre-Conditioning	**Post-Conditioning**
LC-C1-U1-1		
LC-C1-U1-2		
LC-C1-U1-3		

Table F- 13. Test photos for LC-C1-U2-X – antireflective/antiglare/oleophobic coating A – 254 nm for eight years – UV-C method

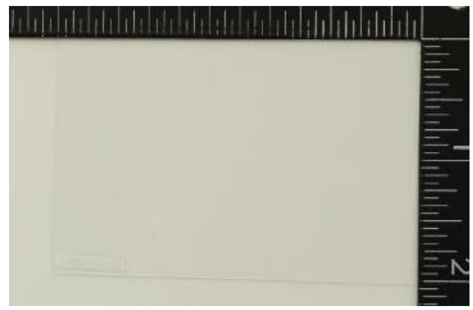
	Pre-Conditioning	Post-Conditioning
LC-C1-U2-1		
LC-C1-U2-2		
LC-C1-U2-3		

Table F- 14. Test photos for LC-C1-U3-X – antireflective/antiglare/oleophobic coating A – 280 nm for eight years – UV-C method

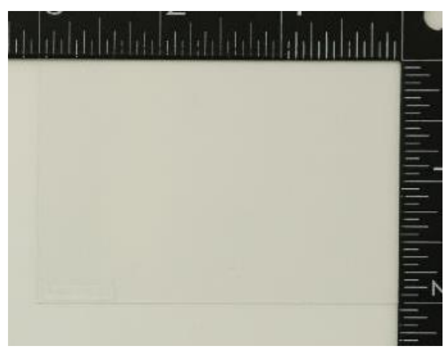
	Pre-Conditioning	Post-Conditioning
LC-C1-U3-1		
LC-C1-U3-2		
LC-C1-U3-3		

Table F- 15. Test photos for LC-C1-U4-X – antireflective/antiglare/oleophobic coating A – 222 nm for four years – UV-C method

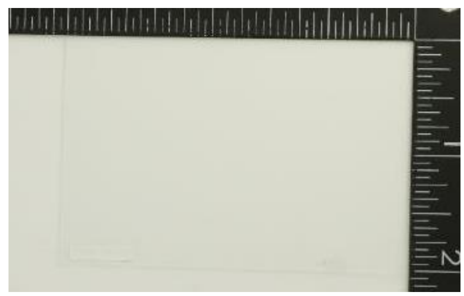
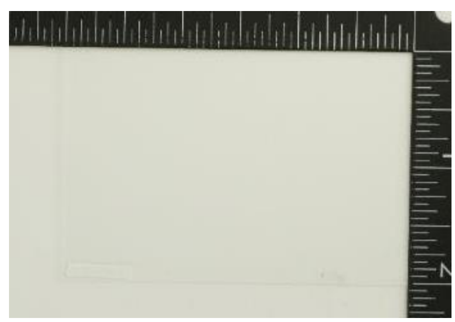
	Pre-Conditioning	**Post-Conditioning**
LC-C1-U4-1		
LC-C1-U4-2		
LC-C1-U4-3		

Table F- 16. Test photos for LC-C1-U5-X – antireflective/antiglare/oleophobic coating A – 254 nm for four years – UV-C method

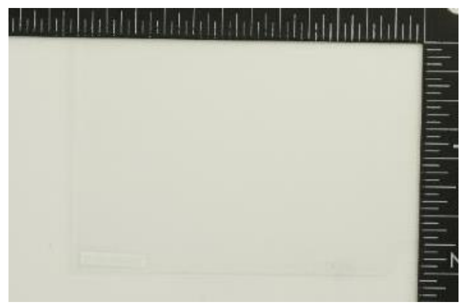
	Pre-Conditioning	**Post-Conditioning**
LC-C1-U5-1		
LC-C1-U5-2		
LC-C1-U5-3		

Table F- 17. Test photos for LC-C1-U6-X – antireflective/antiglare/oleophobic coating A – 280 nm for four years – UV-C method

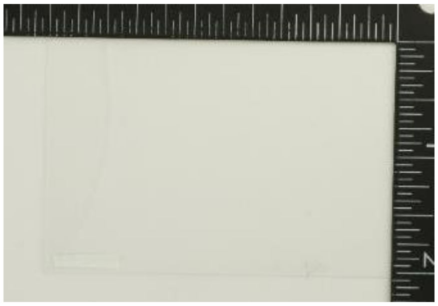
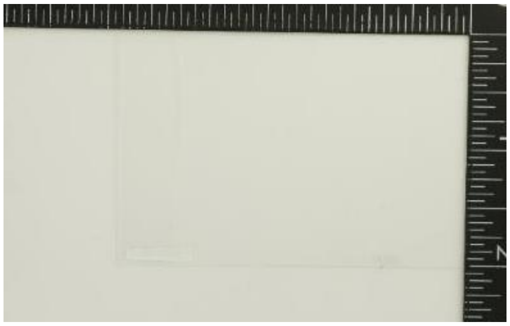
	Pre-Conditioning	Post-Conditioning
LC-C1-U6-1		
LC-C1-U6-2		
LC-C1-U6-3		

Table F- 18. Test photos for LC-C2-C-X – oleophobic coating B – control

	Check-in
LC-C2-C-1	

Table F- 19. Test photos for LC-C2-W1-X – oleophobic coating B – 70% IPA – wiping method

	Pre-Conditioning	**Post-Conditioning**
LC-C2-W1-1		
LC-C2-W1-2		
LC-C2-W1-3		

Table F- 20. Test photos for LC-C2-W2-X – oleophobic coating B – Calla® 1452 – wiping method

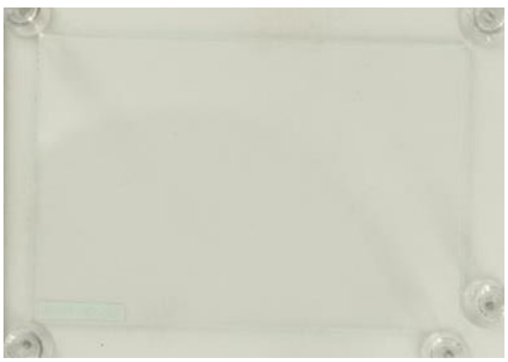
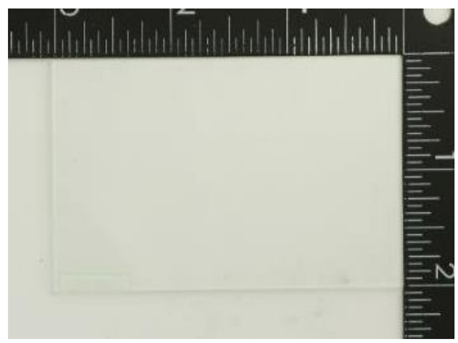
	Pre-Conditioning	Post-Conditioning
LC-C2-W2-1		
LC-C2-W2-2		
LC-C2-W2-3		

Table F- 21. Test photos for LC-C2-W3-X – oleophobic coating B – Sani-Cide EX3 – wiping method

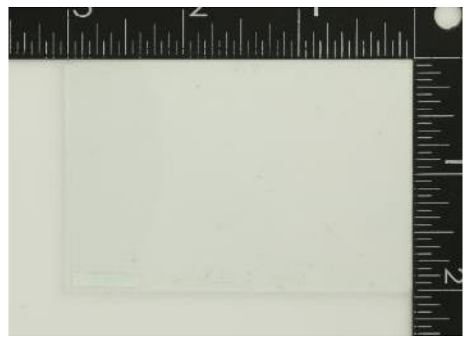
	Pre-Conditioning	Post-Conditioning
LC-C2-W3-1		
LC-C2-W3-2		
LC-C2-W3-3		

Table F- 22. Test photos for LC-C2-W4-X – oleophobic coating B – PREempt™ RTU – wiping method

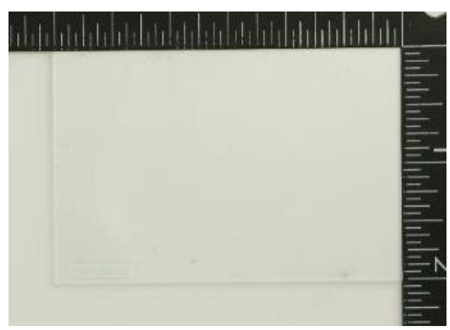
	Pre-Conditioning	Post-Conditioning
LC-C2-W4-1		
LC-C2-W4-2		
LC-C2-W4-3		

Table F- 23. Test photos for LC-C2-W5-X – oleophobic coating B – Bactrokill + – wiping method

	Pre-Conditioning	Post-Conditioning
LC-C2-W5-1		
LC-C2-W5-2		
LC-C2-W5-3		

Table F- 24. Test photos for LC-C2-U1-X – oleophobic coating B – 222 nm for one year – UV-C method

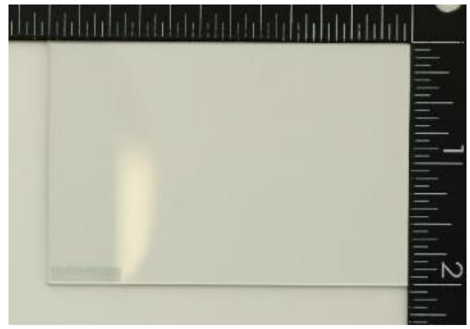
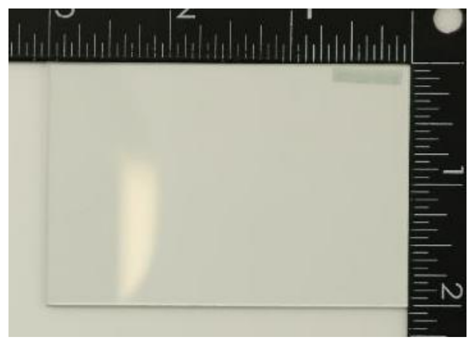
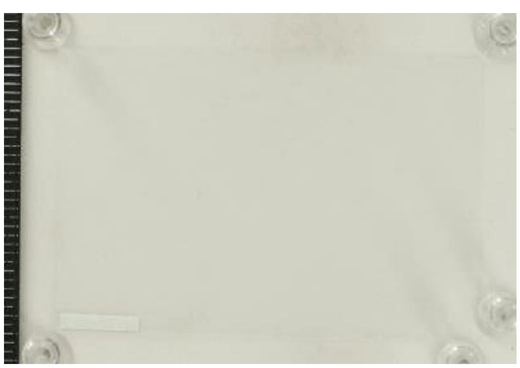
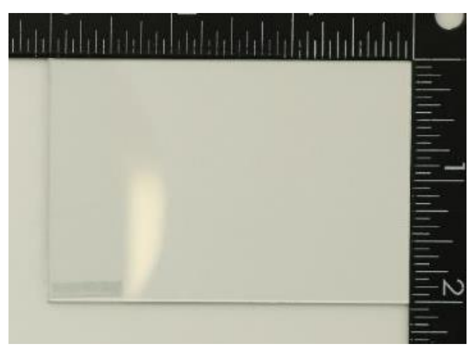
	Pre-Conditioning	**Post-Conditioning**
LC-C2-U1-1		
LC-C2-U1-2		
LC-C2-U1-3		

Table F- 25. Test photos for LC-C2-U2-X – oleophobic coating B – 254 nm for eight years – UV-C method

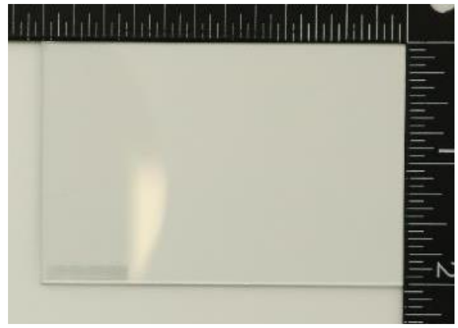
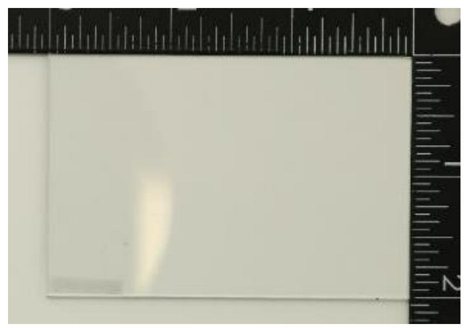
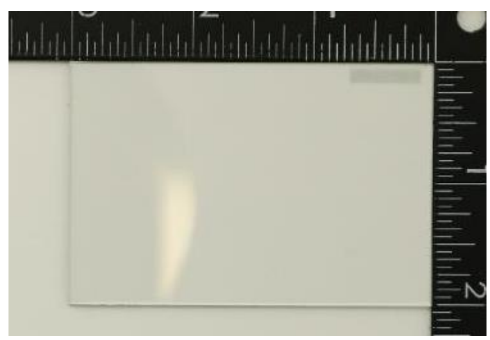
	Pre-Conditioning	Post-Conditioning
LC-C2-U2-1		
LC-C2-U2-2		
LC-C2-U2-3		

Table F- 26. Test photos for LC-C2-U3-X – oleophobic coating B – 280 nm for eight years – UV-C method

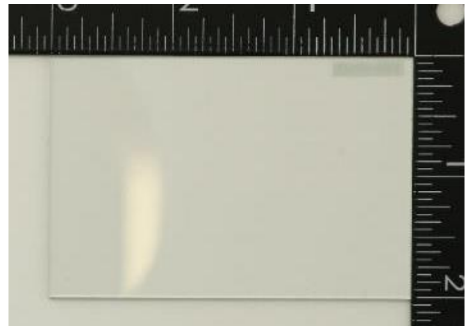
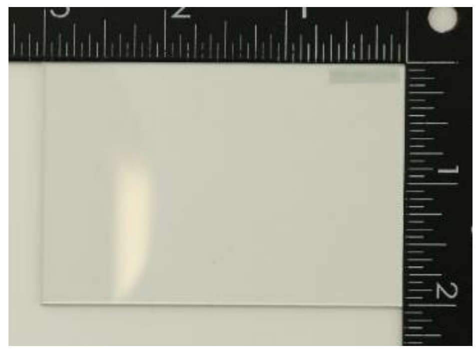
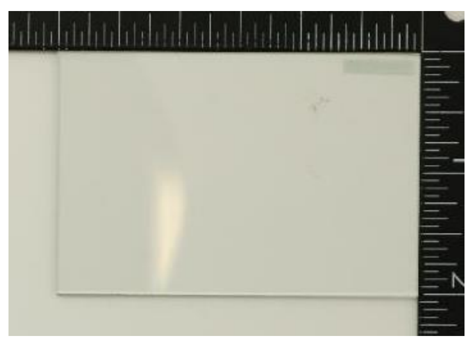
	Pre-Conditioning	Post-Conditioning
LC-C2-U3-1		
LC-C2-U3-2		
LC-C2-U3-3		

Table F- 27. Test photos for LC-C2-U4-X – oleophobic coating B – 222 nm for four years – UV-C method

	Pre-Conditioning	**Post-Conditioning**
LC-C2-U4-1		
LC-C2-U4-2		
LC-C2-U4-3		

Table F- 28. Test photos for LC-C2-U5-X – oleophobic coating B – 254 nm for four years – UV-C method

	Pre-Conditioning	Post-Conditioning
LC-C2-U5-1		
LC-C2-U5-2		
LC-C2-U5-3		

Table F- 29. Test photos for LC-C2-U6-X – oleophobic coating B – 280 nm for four years – UV-C method

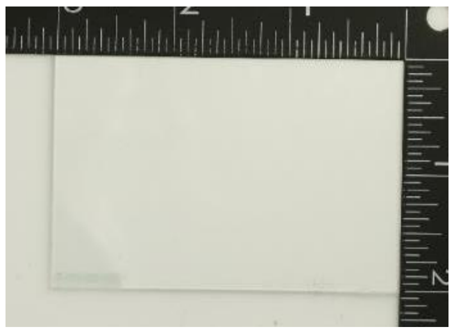
	Pre-Conditioning	Post-Conditioning
LC-C2-U6-1		
LC-C2-U6-2		
LC-C2-U6-3		

Table F- 30. Test photos for LC-C3-C-X – oleophobic coating C – control

	Check-in
LC-C3-C-1	

able F- 31. Test photos for LC-C3-W1-X – oleophobic coating C – 70% IPA – wiping method

	Pre-Conditioning	**Post-Conditioning**
LC-C3-W1-1		
LC-C3-W1-2		
LC-C3-W1-3		

Table F- 32. Test photos for LC-C3-W2-X – oleophobic coating C – Calla® 1452 – wiping method

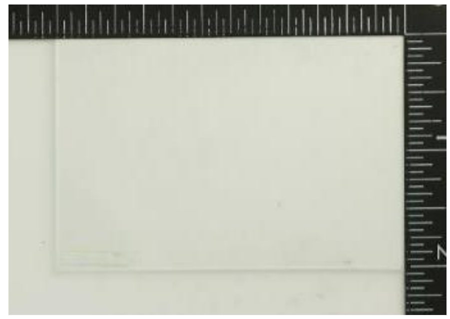
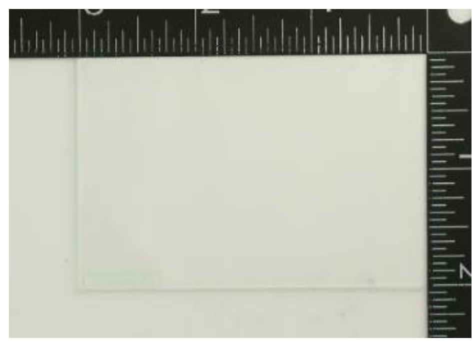
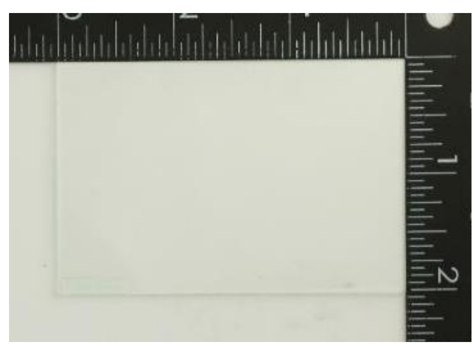
	Pre-Conditioning	Post-Conditioning
LC-C3-W2-1		
LC-C3-W2-2		
LC-C3-W2-3		

Table F- 33. Test photos for LC-C3-W3-X – oleophobic coating C – Sani-Cide EX3 – wiping method

	Pre-Conditioning	Post-Conditioning
LC-C3-W3-1		
LC-C3-W3-2		
LC-C3-W3-3		

Table F- 34. Test photos for LC-C3-W4-X – oleophobic coating C – PREempt™ RTU – wiping method

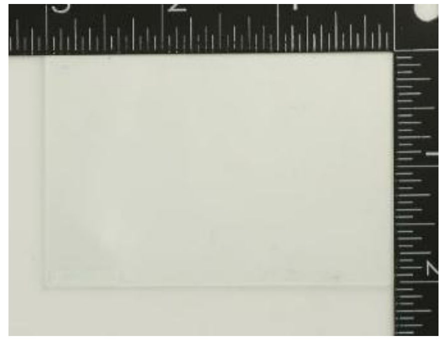
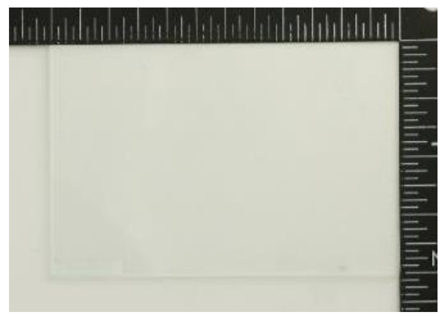
	Pre-Conditioning	**Post-Conditioning**
LC-C3-W4-1		
LC-C3-W4-2		
LC-C3-W4-3		

Table F- 35. Test photos for LC-C3-W5-X – oleophobic coating C – Bactrokill + – wiping method

	Pre-Conditioning	Post-Conditioning
LC-C3-W5-1		
LC-C3-W5-2		
LC-C3-W5-3		

Table F- 36. Test photos for LC-C3-U1-X – oleophobic coating C – 222 nm for one year – UV-C method

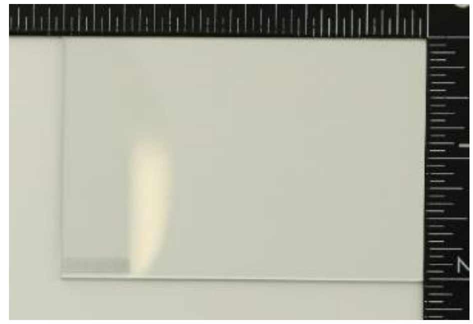
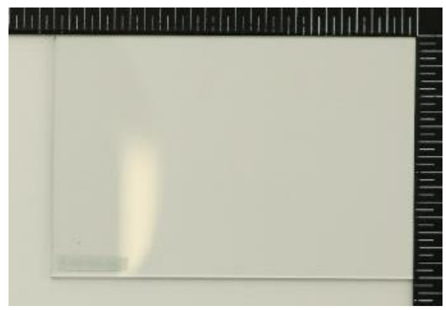
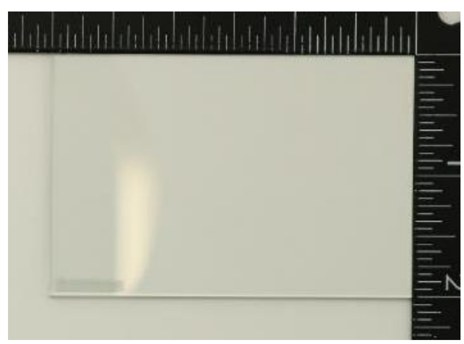
	Pre-Conditioning	**Post-Conditioning**
LC-C3-U1-1		
LC-C3-U1-2		
LC-C3-U1-3		

Table F- 37. Test photos for LC-C3-U2-X – oleophobic coating C – 254 nm for one year – UV-C method

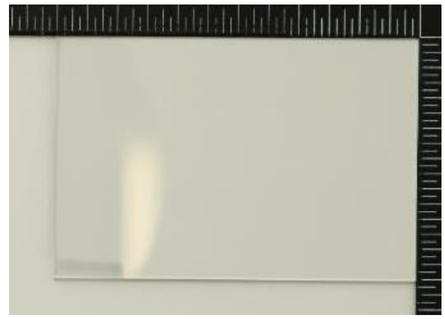
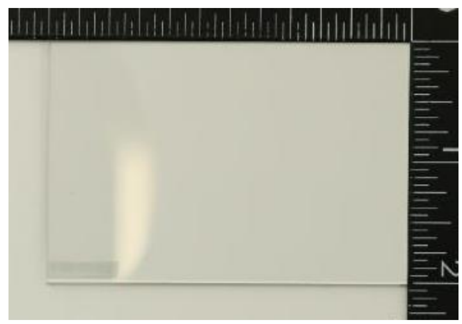
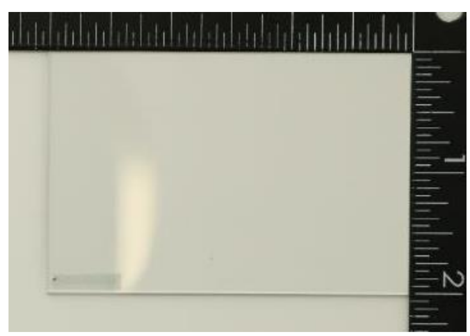
	Pre-Conditioning	**Post-Conditioning**
LC-C3-U2-1		
LC-C3-U2-2		
LC-C3-U2-3		

Table F- 38. Test photos for LC-C3-U3-X – oleophobic coating C – 280 nm for eight years – UV-C method

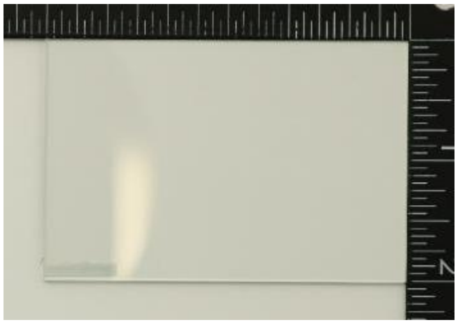
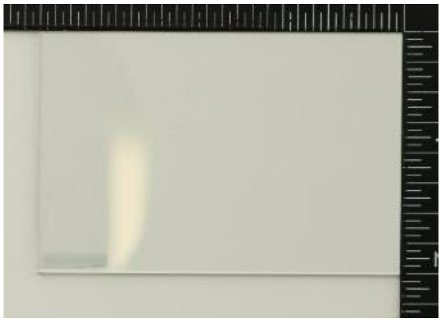
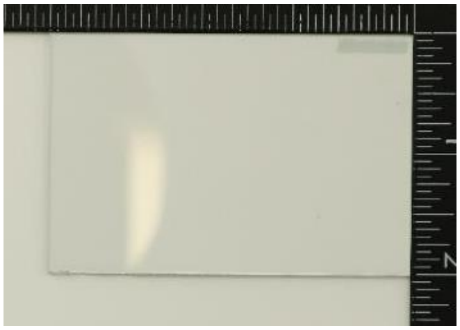
	Pre-Conditioning	Post-Conditioning
LC-C3-U3-1		
LC-C3-U3-2		
LC-C3-U3-3		

Table F- 39. Test photos for LC-C3-U4-X – oleophobic coating C – 222 nm for four years – UV-C method

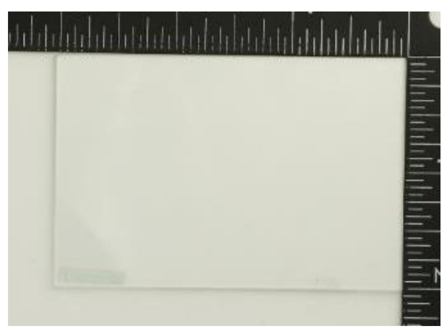
	Pre-Conditioning	Post-Conditioning
LC-C3-U4-1		
LC-C3-U4-2		
LC-C3-U4-3		

Table F- 40. Test photos for LC-C3-U5-X – oleophobic coating C – 254 nm for four years – UV-C method

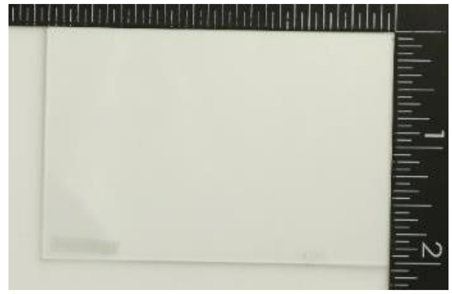
	Pre-Conditioning	**Post-Conditioning**
LC-C3-U5-1		
LC-C3-U5-2		
LC-C3-U5-3		

Table F- 41. Test photos for LC-C3-U6-X – oleophobic coating C – 280 nm for four years – UV-C method

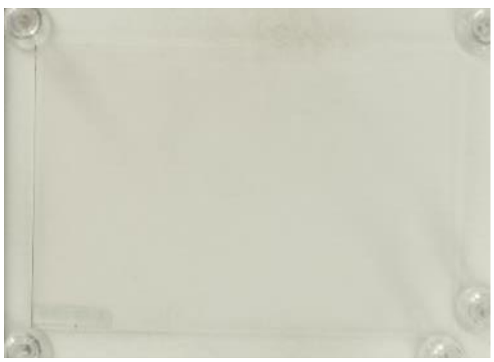
	Pre-Conditioning	**Post-Conditioning**
LC-C3-U6-1		
LC-C3-U6-2		
LC-C3-U6-3		

Table F- 42. Test photos for LC-C4-C-X - oleophobic coating D – control

	Check-In
LC-C4-C-1	

Table F- 43. Test photos for LC-C4-W1-X – oleophobic coating D – 70% IPA – wiping method

	Pre-Conditioning	Post-Conditioning
LC-C4-W1 -1		
LC-C4-W1-2		
LC-C4-W1-3		

Table F- 44. Test photos for LC-C4-W2-X – oleophobic coating D – Calla® 1452 – wiping method

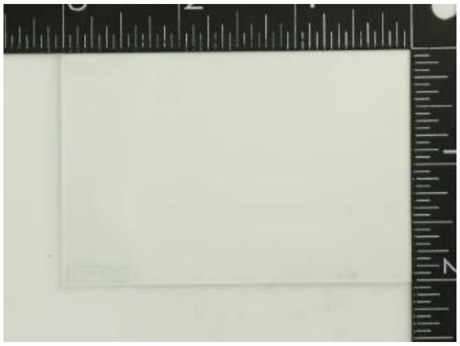
	Pre-Conditioning	Post-Conditioning
LC-C4-W2 -1		
LC-C4-W2-2		
LC-C4-W2-3		

Table F- 45. Test photos for LC-C4-W3-X – oleophobic coating D – Sani-Cide EX3 – wiping method

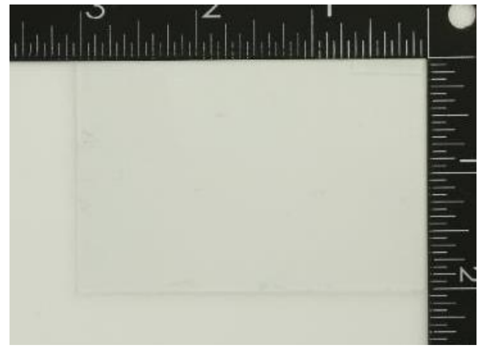
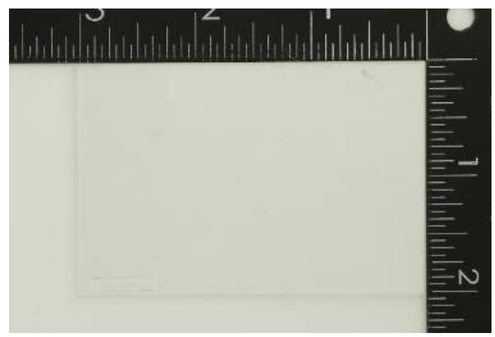
	Pre-Conditioning	**Post-Conditioning**
LC-C4-W3 -1		
LC-C4-W3-2		
LC-C4-W3-3		

Table F- 46. Test photos for LC-C4-W4-X – oleophobic coating D – PREempt™ RTU – wiping method

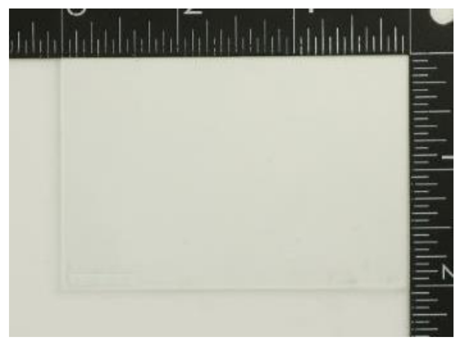
	Pre-Conditioning	Post-Conditioning
LC-C4-W4 -1		
LC-C4-W4-2		
LC-C4-W4-3		

Table F- 47. Test photos for LC-C4-W5-X – oleophobic coating D – Bactrokill + – wiping method

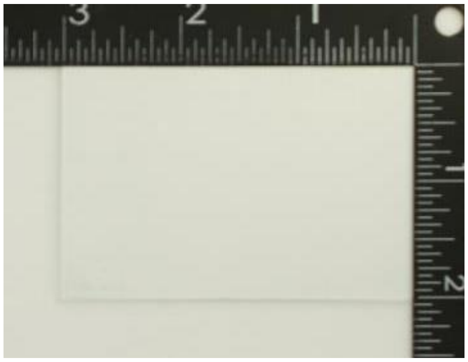
	Pre-Conditioning	Post-Conditioning
LC-C4-W5 -1		
LC-C4-W5-2		
LC-C4-W5-3		

Table F- 48. Test photos for LC-C4-U1-X – oleophobic coating D – 222 nm for one year – UV-C method

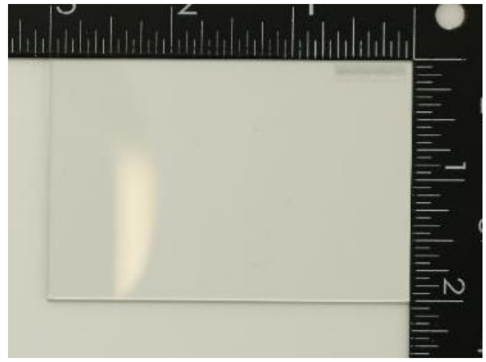
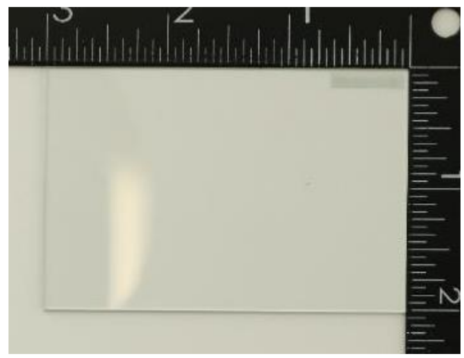
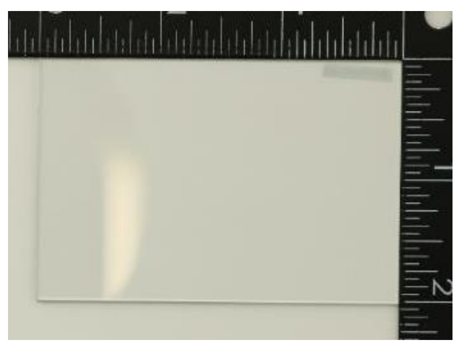
	Pre-Conditioning	Post-Conditioning
LC-C4-U1 -1		
LC-C4-U1-2		
LC-C4-U1-3		

Table F- 49. Test photos for LC-C4-U1-X – oleophobic coating D – 222 nm for one year – UV-C method

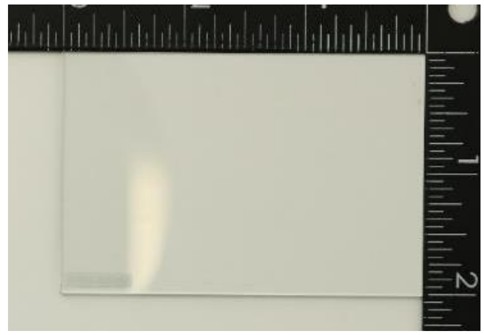
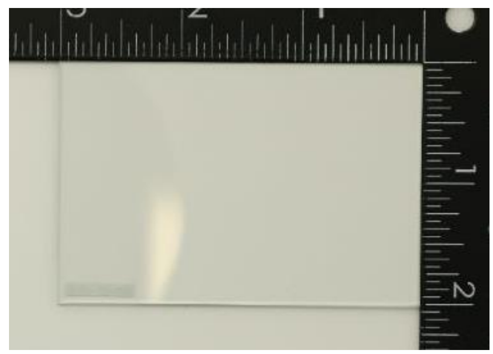
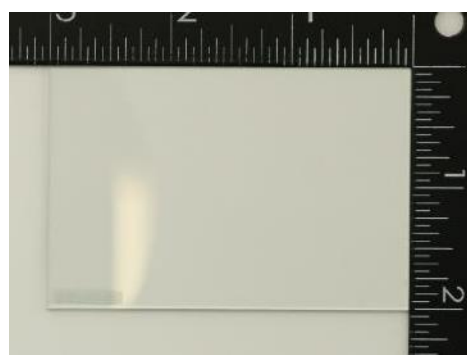
	Pre-Conditioning	**Post-Conditioning**
LC-C4-U2-1		
LC-C4-U2-2		
LC-C4-U2-3		

Table F- 50. Test photos for LC-C4-U3-X – oleophobic coating D – 280 nm for one year – UV-C method

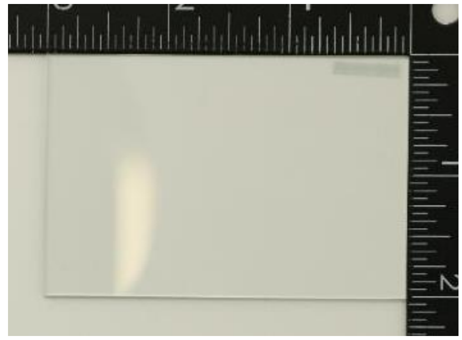
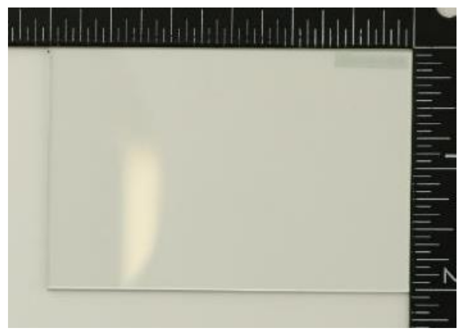
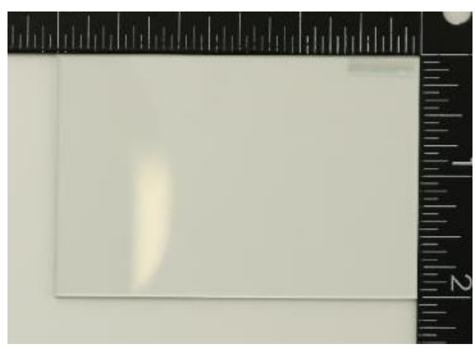
	Pre-Conditioning	Post-Conditioning
LC-C4-U3-1		
LC-C4-U3-2		
LC-C4-U3-3		

Table F- 51. Test photos for LC-C4-U4-X – oleophobic coating D – 222 nm for four years – UV-C method

	Pre-Conditioning	Post-Conditioning
LC-C4-U4-1		
LC-C4-U4-2		
LC-C4-U4-3		

Table F- 52. Test photos for LC-C4-U5-X – oleophobic coating D – 254 nm for four years – UV-C method

	Pre-Conditioning	Post-Conditioning
LC-C4-U5-1		
LC-C4-U5-2		
LC-C4-U5-3		

Table F- 53. Test photos for LC-C4-U6-X – oleophobic coating D – 250nm for four years – UV-C method

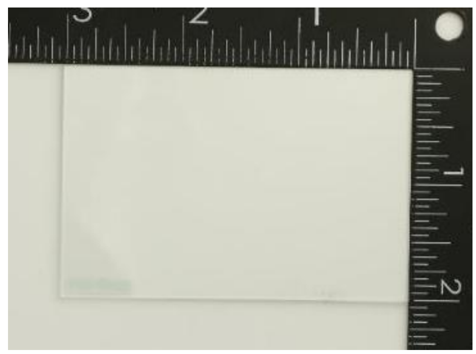
	Pre-Conditioning	Post-Conditioning
LC-C4-U6-1		
LC-C4-U6-2		
LC-C4-U6-3		

Table F- 54. Test photos for LC-C5-C-X – antireflective/antiglare/conductive/oleophobic coating A – control

	Check-in
LC-C5-C-1	

Table F- 55. Test photos for LC-C5-W1-X – antireflective/antiglare/conductive/oleophobic coating A – 70% IPA – wiping method

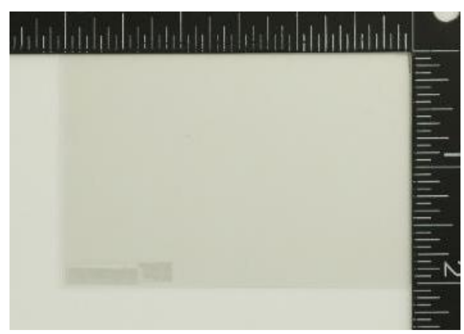
	Pre-Conditioning	Post-Conditioning
LC-C5-W1 -1		
LC-C5-W1-2		
LC-C5-W1-3		

Table F- 56. Test photos for LC-C5-W2-X – antireflective/antiglare/conductive/oleophobic coating A – Calla® 1452 – wiping method

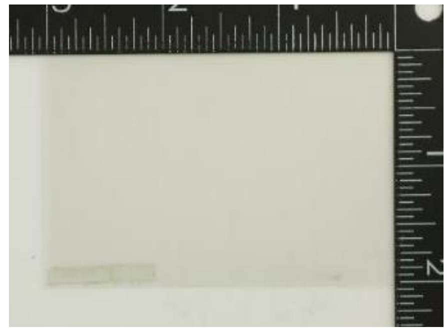
	Pre-Conditioning	Post-Conditioning
LC-C5-W2 -1		
LC-C5-W2-2		
LC-C5-W2-3		

Table F- 57. Test photos for LC-C5-W3-X – antireflective/antiglare/conductive/oleophobic coating A – Sani-Cide EX3 – wiping method

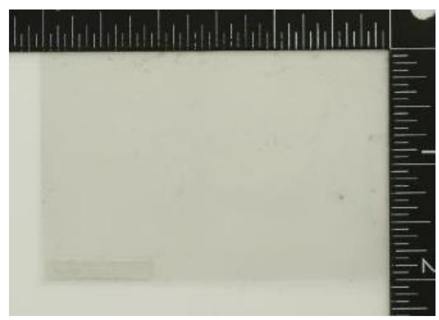
	Pre-Conditioning	Post-Conditioning
LC-C5-W3 -1		
LC-C5-W3-2		
LC-C5-W3-3		

Table F- 58. Test Photos for LC-C5-W4-X – Antireflective/Antiglare/ conductive/ Oleophobic coating A – PREempt™ RTU – wiping method

	Pre-Conditioning	**Post-Conditioning**
LC-C5-W4 -1		
LC-C5-W4-2		
LC-C5-W4-3		

Table F- 59. Test photos for LC-C5-W5-X – antireflective/antiglare/conductive/oleophobic coating A – Bactrokill + – wiping method

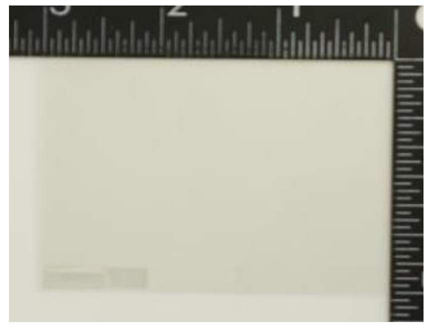
	Pre-Conditioning	Post-Conditioning
LC-C5-W5 -1		
LC-C5-W5-2		
LC-C5-W5-3		

Table F- 60. Test photos for LC-C5-U1-X – antireflective/antiglare/conductive/oleophobic coating A – 222 nm for eight years – UV-C method

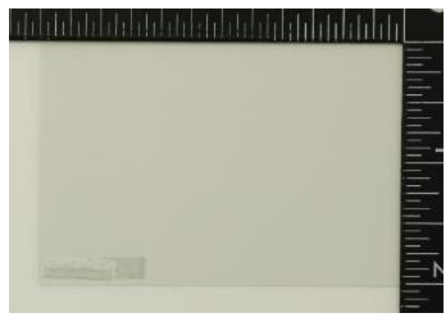
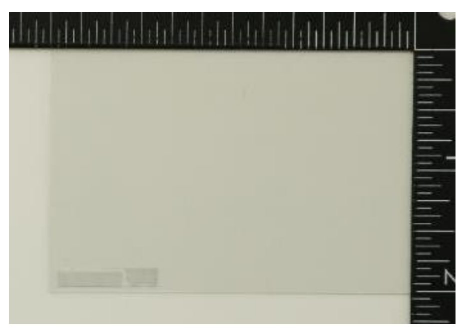
	Pre-Conditioning	Post-Conditioning
LC-C5-U1 -1		
LC-C5-U1-2		
LC-C5-U1-3		

Table F- 61. Test photos for LC-C5-U2-X – antireflective/antiglare/conductive/oleophobic coating A – 254 nm for eight years – UV-C method

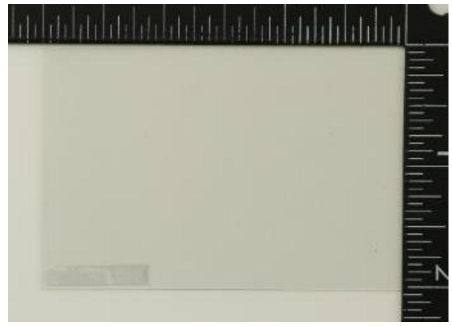
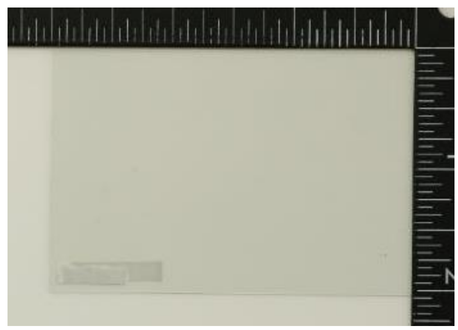
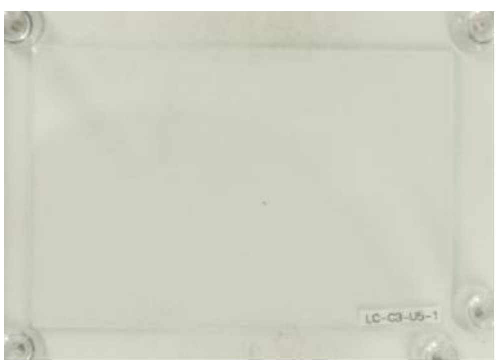
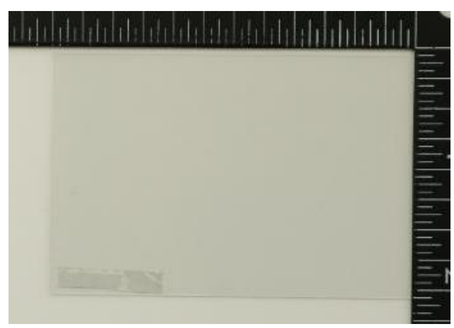
	Pre-Conditioning	**Post-Conditioning**
LC-C5-U2 -1		
LC-C5-U2-2		
LC-C5-U2-3		

Table F- 62. Test photos for LC-C5-U3-X – antireflective/antiglare/conductive/oleophobic coating A – 280 nm for eight years – UV-C method

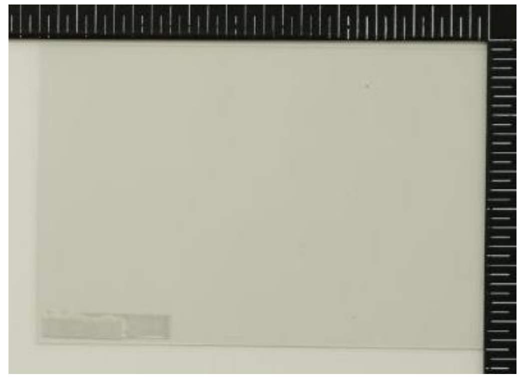
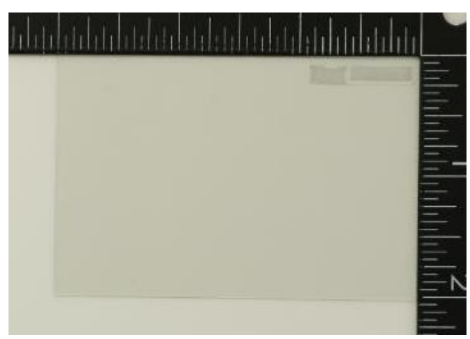
	Pre-Conditioning	Post-Conditioning
LC-C5-U3 -1		
LC-C5-U3-2		
LC-C5-U3-3		

Table F- 63. Test photos for LC-C5-U4-X –antireflective/antiglare/conductive/oleophobic coating A – 222 nm for four years – UV-C method

	Pre-Conditioning	Post-Conditioning
LC-C5-U4 -1		
LC-C5-U4-2		
LC-C5-U4-3		

Table F- 64. Test photos for LC-C5-U5-X – antireflective/antiglare/conductive/oleophobic coating A – 254 nm for four years – UV-C method

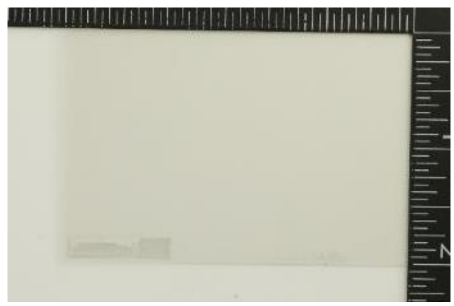
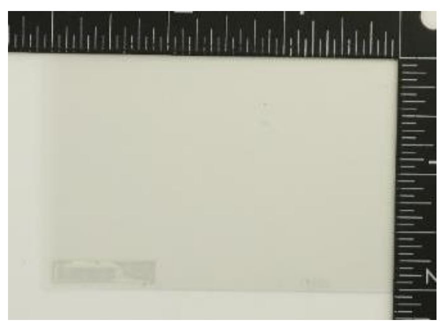
	Pre-Conditioning	Post-Conditioning
LC-C5-U5 -1		
LC-C5-U5-2		
LC-C5-U5-3		

Table F- 65. Test photos for LC-C5-U6-X – antireflective/antiglare/conductive/oleophobic coating A – 280 nm for four years – UV-C method

	Pre-Conditioning.	Post-Conditioning
LC-C5-U6 -1		
LC-C5-U6-2		
LC-C5-U6-3		

Table F- 66. Test photos for L-C6-C-X – antireflective/conductive coating – control

	Check-in
L-C6-C-1	

Table F- 67. Test photos for L-C6-W1-X – antireflective/conductive coating – 70% IPA – wiping method

	Pre-Conditioning	Post-Conditioning
L-C6-W1 -1		
L-C6-W1-2		
L-C6-W1-3		

Table F- 68. Test photos for L-C6-W2-X – antireflective/conductive coating – Calla® 1452 – wiping method

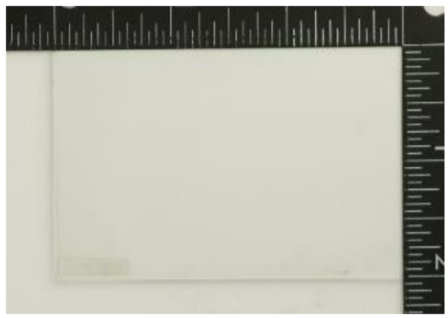
	Pre-Conditioning	Post-Conditioning
L-C6-W2 -1		
L-C6-W2-2		
L-C6-W2-3		

Table F- 69. Test photos for L-C6-W3-X – antireflective/conductive coating – Sani-Cide EX3 – wiping method

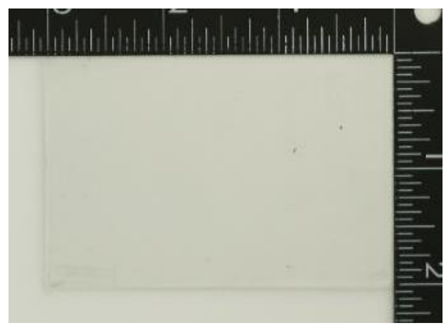
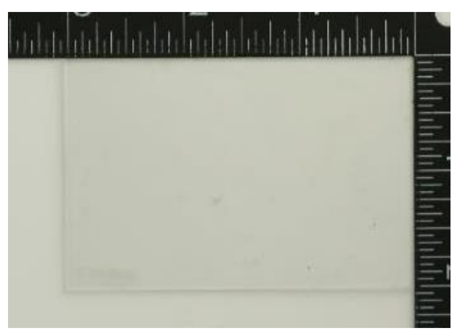
	Pre-Conditioning	Post-Conditioning
L-C6-W3 -1		
L-C6-W3-2		
L-C6-W3-3		

Table F- 70. Test photos for L-C6-W4-X – antireflective/conductive coating – PREempt™ RTU – wiping method

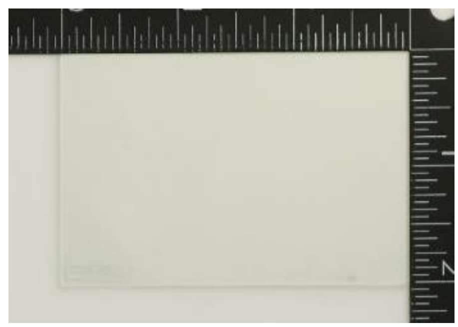
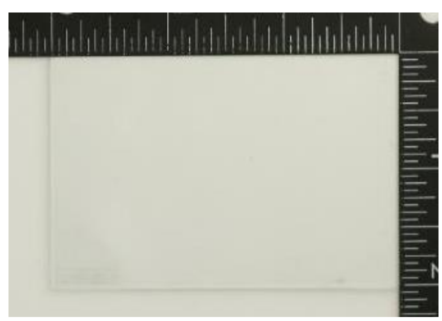
	Pre-Conditioning	Post-Conditioning
L-C6-W4 -1		
L-C6-W4-2		
L-C6-W4-3		

Table F- 71. Test photo for L-C6-W5-X – antireflective/conductive coating – Bactrokill + – wiping method

	Pre-Conditioning	**Post-Conditioning**
L-C6-W5 -1		
L-C6-W5-2		
L-C6-W5-3		

Table F- 72. Test photos for L-C6-U1-X – antireflective/conductive coating – 222 nm for one year – UV-C method

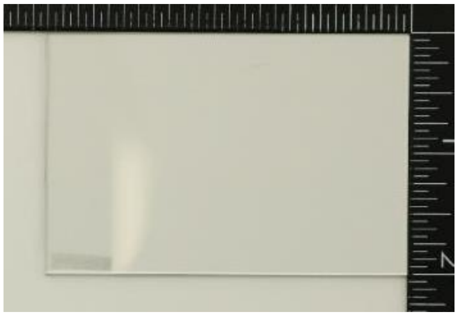
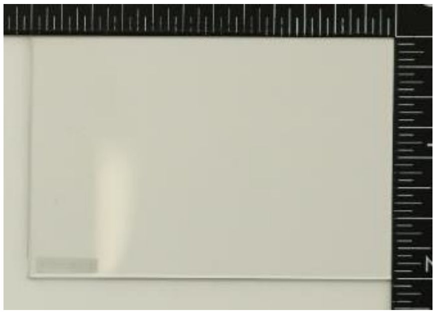
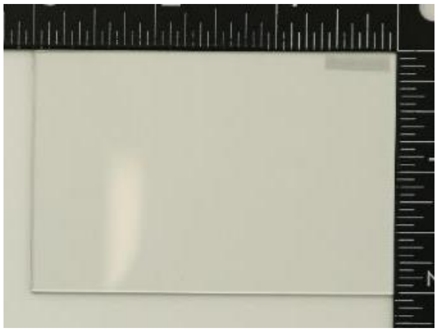
	Pre-Conditioning	Post-Conditioning
L-C6-U1 -1		
L-C6-U1-2		
L-C6-U1-3		

Table F- 73. Test photos for L-C6-U2-X – antireflective/conductive coating – 254 nm for one years – UV-C method

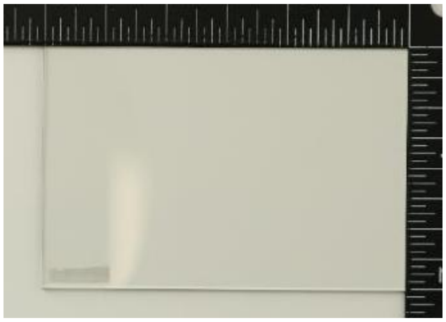
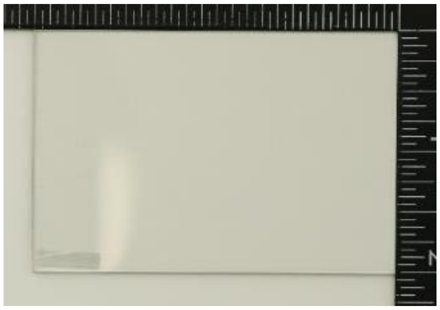
	Pre-Conditioning	Post-Conditioning
L-C6-U2 -1		
L-C6-U2-2		
L-C6-U2-3		

Table F- 74. Test photos for L-C6-U3-X – antireflective/conductive coating – 280 nm for eight years – UV-C method

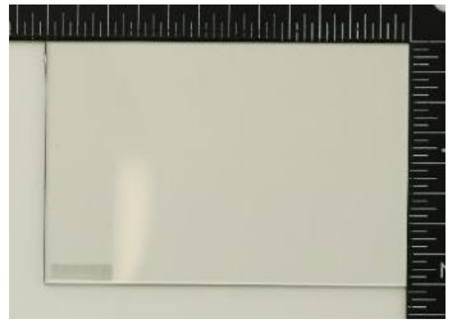
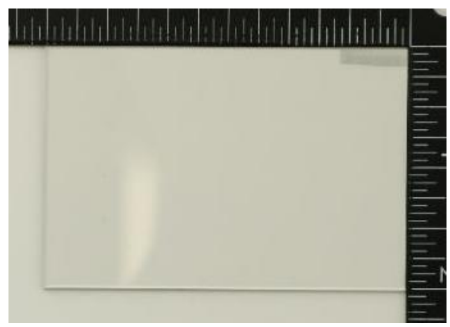
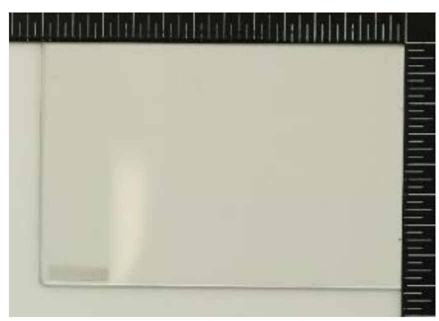
	Pre-Conditioning	Post-Conditioning
L-C6-U3 -1		
L-C6-U3-2		
L-C6-U3-3		

Table F- 75. Test photos for L-C6-U4-X – antireflective/conductive coating – 222 nm for four years – UV-C method

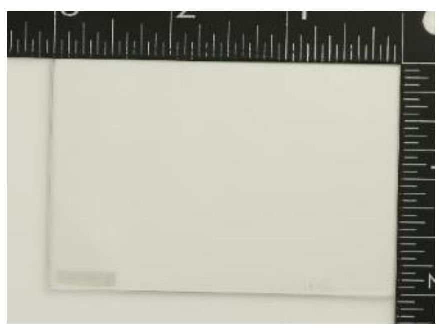
	Pre-Conditioning	Post-Conditioning
L-C6-U4 -1		
L-C6-U4-2		
L-C6-U4-3		

Table F- 76. Test photos for L-C6-U5-X – antireflective/conductive coating – 254 nm for four years – UV-C method

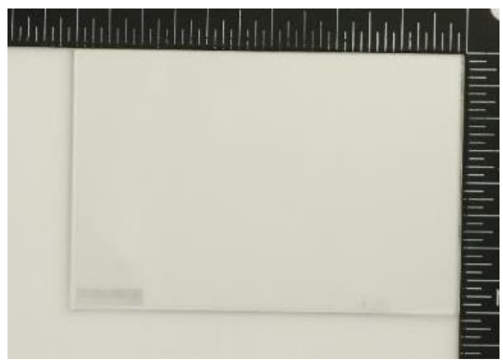
	Pre-Conditioning	Post-Conditioning
L-C6-U5 -1		
L-C6-U5-2		
L-C6-U5-3		

Table F- 77. Test photos for L-C6-U6-X – antireflective/conductive coating – 280 nm for four years – UV-C method

	Pre-Conditioning	Post-Conditioning
L-C6-U6 -1		
L-C6-U6-2		
L-C6-U6-3		

G Light transmission and haze test data

Table G- 1. Light transmission & haze test data – antireflective/antiglare/oleophobic coating A

Test Article ID	Total Luminous Transmittance	Diffuse Luminous Transmittance	Percent Haze
LC-C1-C-1	96.3	24.94	25.9
LC-C1-W1-1	96.1	23.93	24.9
LC-C1-W1-2	96.1	23.74	24.7
LC-C1-W1-3	96	24	25
LC-C1-W2-1	95.9	53.03	55.3
LC-C1-W2-2	95.8	51.16	53.4
LC-C1-W2-3	95.7	45.46	47.5
LC-C1-W3-1	94.9	48.4	51
LC-C1-W3-2	95.2	43.7	45.9
LC-C1-W3-3	93.9	49.11	52.3
LC-C1-W4-1	94.3	56.49	59.9
LC-C1-W4-2	93.7	56.31	60.1
LC-C1-W4-3	93.8	52.72	56.2
LC-C1-W5-1	93.8	28.42	30.3
LC-C1-W5-2	94	27.82	29.6
LC-C1-W5-3	93.9	24.98	26.6
LC-C1-U1-1	96.1	24.09	25.07
LC-C1-U1-2	96.1	24.15	25.13
LC-C1-U1-3	96.1	24.15	25.13
LC-C1-U2-1	96.1	23.83	24.8
LC-C1-U2-2	96.1	23.90	24.87
LC-C1-U2-3	96.1	24.00	24.97
LC-C1-U3-1	96.1	24.09	25.07
LC-C1-U3-2	96.07	24.02	25
LC-C1-U3-3	95.87	24.00	25.03
LC-C1-U4-1	96.3	24.17	25.1
LC-C1-U4-2	96.4	24.39	25.3
LC-C1-U4-3	96.4	23.91	24.8
LC-C1-U5-1	96.3	23.98	24.9

Test Article ID	Total Luminous Transmittance	Diffuse Luminous Transmittance	Percent Haze
LC-C1-U5-2	96.4	24.39	25.3
LC-C1-U5-3	96.3	24.56	25.5
LC-C1-U6-1	96.4	24.29	25.2
LC-C1-U6-2	96.4	24.29	25.2
LC-C1-U6-3	96.4	24.49	25.4

Table G- 2. Light transmission & haze test data – oleophobic coating B

Test Article ID	Total Luminous Transmittance	Diffuse Luminous Transmittance	Percent Haze
LC-C2-C-1	93.3	0.76	0.81
LC-C2-W1-1	93.1	0.69	0.74
LC-C2-W1-2	93.1	0.61	0.66
LC-C2-W1-3	93.1	0.42	0.45
LC-C2-W2-1	92.9	4.66	5.02
LC-C2-W2-2	92.9	20.53	22.1
LC-C2-W2-3	92.9	12.54	13.5
LC-C2-W3-1	92.2	28.86	31.3
LC-C2-W3-2	92.8	18.65	20.1
LC-C2-W3-3	92.9	22.3	24
LC-C2-W4-1	92.3	16.15	17.5
LC-C2-W4-2	92.4	26.8	29
LC-C2-W4-3	92.6	22.5	24.3
LC-C2-W5-1	93.2	6.41	6.88
LC-C2-W5-2	93.3	4.39	4.71
LC-C2-W5-3	93.2	2.94	3.15
LC-C2-U1-1	92.7	0.70	0.75
LC-C2-U1-2	92.83	0.68	0.73
LC-C2-U1-3	92.7	0.53	0.57
LC-C2-U2-1	92.7	0.83	0.89
LC-C2-U2-2	92.7	0.76	0.82
LC-C2-U2-3	92.6	1.03	1.11
LC-C2-U3-1	92.8	0.73	0.79
LC-C2-U3-2	92.8	0.96	1.03

Test Article ID	Total Luminous Transmittance	Diffuse Luminous Transmittance	Percent Haze
LC-C2-U3-3	92.8	0.94	1.01
LC-C2-U4-1	93	0.63	0.68
LC-C2-U4-2	93.1	0.67	0.72
LC-C2-U4-3	93	0.63	0.68
LC-C2-U5-1	92.9	0.81	0.87
LC-C2-U5-2	92.9	0.69	0.74
LC-C2-U5-3	92.9	0.93	1
LC-C2-U6-1	93.1	1.15	1.24
LC-C2-U6-2	93.1	0.76	0.82
LC-C2-U6-3	93.1	0.66	0.71

Table G- 3. Light transmission & haze test data – oleophobic coating C

Test Article ID	Total Luminous Transmittance	Diffuse Luminous Transmittance	Percent Haze
LC-C3-C-1	93.2	0.51	0.55
LC-C3-W1-1	93.1	0.34	0.37
LC-C3-W1-2	93.1	0.38	0.41
LC-C3-W1-3	93.1	0.41	0.44
LC-C3-W2-1	93.1	6.34	6.81
LC-C3-W2-2	93	13.67	14.7
LC-C3-W2-3	93	7.17	7.71
LC-C3-W3-1	92.5	19.06	20.6
LC-C3-W3-2	92.8	20.14	21.7
LC-C3-W3-3	92.9	23.78	25.6
LC-C3-W4-1	91.9	21.78	23.7
LC-C3-W4-2	90.4	27.57	30.5
LC-C3-W4-3	91.8	27.72	30.2
LC-C3-W5-1	93.3	8.27	8.86
LC-C3-W5-2	93.2	4.4	4.72
LC-C3-W5-3	93.3	5.26	5.64
LC-C3-U1-1	92.8	0.39	0.42
LC-C3-U1-2	92.8	0.62	0.67
LC-C3-U1-3	92.8	0.38	0.41

Test Article ID	Total Luminous Transmittance	Diffuse Luminous Transmittance	Percent Haze
LC-C3-U2-1	92.6	0.69	0.74
LC-C3-U2-2	92.5	0.52	0.56
LC-C3-U2-3	92.5	0.45	0.49
LC-C3-U3-1	92.8	0.45	0.48
LC-C3-U3-2	92.7	0.57	0.61
LC-C3-U3-3	92.7	0.46	0.5
LC-C3-U4-1	93	0.52	0.56
LC-C3-U4-2	93	0.47	0.51
LC-C3-U4-3	93	0.78	0.84
LC-C3-U5-1	92.8	0.66	0.71
LC-C3-U5-2	92.9	0.78	0.84
LC-C3-U5-3	92.8	0.67	0.72
LC-C3-U6-1	93	0.48	0.52
LC-C3-U6-2	93	0.52	0.56
LC-C3-U6-3	92.9	0.73	0.79

Table G- 4. Light transmission & haze test data – oleophobic coating D

Test Article ID	Total Luminous Transmittance	Diffuse Luminous Transmittance	Percent Haze
LC-C4-C-1	93.3	1.09	1.17
LC-C4-W1-1	93.1	0.74	0.79
LC-C4-W1-2	93.1	0.69	0.74
LC-C4-W1-3	93.1	0.82	0.88
LC-C4-W2-1	93	2.81	3.02
LC-C4-W2-2	93	3.83	4.12
LC-C4-W2-3	93	7.6	8.17
LC-C4-W3-1	92.8	33.04	35.6
LC-C4-W3-2	92.8	39.25	42.3
LC-C4-W3-3	92.6	36.11	39
LC-C4-W4-1	92.1	27.81	30.2
LC-C4-W4-2	92.1	34.54	37.5
LC-C4-W4-3	92.4	36.59	39.6
LC-C4-W5-1	93	3.31	3.56

Test Article ID	Total Luminous Transmittance	Diffuse Luminous Transmittance	Percent Haze
LC-C4-W5-2	93.1	8.84	9.49
LC-C4-W5-3	93.2	9.24	9.91
LC-C4-U1-1	92.8	0.76	0.82
LC-C4-U1-2	92.8	0.81	0.87
LC-C4-U1-3	92.8	0.84	0.91
LC-C4-U2-1	92.8	0.80	0.86
LC-C4-U2-2	92.8	0.84	0.91
LC-C4-U2-3	92.8	0.94	1.01
LC-C4-U3-1	92.9	0.57	0.61
LC-C4-U3-2	93	0.92	0.99
LC-C4-U3-3	92.9	0.76	0.82
LC-C4-U4-1	93	1.27	1.37
LC-C4-U4-2	93	1.49	1.6
LC-C4-U4-3	92.9	1.58	1.7
LC-C4-U5-1	93	1.47	1.58
LC-C4-U5-2	93.1	2.54	2.73
LC-C4-U5-3	93	1.81	1.95
LC-C4-U6-1	93.2	1.44	1.55
LC-C4-U6-2	93.1	1.45	1.56
LC-C4-U6-3	93.2	1.24	1.33

Table G- 5. Light transmission & haze test data – antireflective/antiglare/conductive/oleophobic coating A

Test Article ID	Total Luminous Transmittance	Diffuse Luminous Transmittance	Percent Haze
LC-C5-C-1	90.5	14.75	16.3
LC-C5-W1-1	90.3	14.27	15.8
LC-C5-W1-2	89.8	11.67	13
LC-C5-W1-3	89.6	11.38	12.7
LC-C5-W2-1	88.3	21.28	24.1
LC-C5-W2-2	88.3	24.55	27.8

Test Article ID	Total Luminous Transmittance	Diffuse Luminous Transmittance	Percent Haze
LC-C5-W2-3	88.6	25.16	28.4
LC-C5-W3-1	88.4	30.59	34.6
LC-C5-W3-2	88.8	33.48	37.7
LC-C5-W3-3	88	35.29	40.1
LC-C5-W4-1	89	41.21	46.3
LC-C5-W4-2	89.5	30.61	34.2
LC-C5-W4-3	89.7	35.43	39.5
LC-C5-W5-1	88	13.99	15.9
LC-C5-W5-2	86.7	14.57	16.8
LC-C5-W5-3	89.2	15.61	17.5
LC-C5-U1-1	90.1	13.58	15.07
LC-C5-U1-2	90.27	13.75	15.23
LC-C5-U1-3	90.2	13.50	14.97
LC-C5-U2-1	90.4	13.17	14.57
LC-C5-U2-2	90.6	12.66	13.97
LC-C5-U2-3	90.3	12.55	13.9
LC-C5-U3-1	90.3	12.31	13.63
LC-C5-U3-2	90.2	13.11	14.53
LC-C5-U3-3	90	13.38	14.87
LC-C5-U4-1	90.3	13.18	14.6
LC-C5-U4-2	90.3	14	15.5
LC-C5-U4-3	90	12.87	14.3
LC-C5-U5-1	90.4	13.47	14.9
LC-C5-U5-2	89.9	16.54	18.4
LC-C5-U5-3	89.9	16.9	18.8
LC-C5-U6-1	90.1	16.67	18.5
LC-C5-U6-2	90	16.65	18.5
LC-C5-U6-3	90.4	15.01	16.6

Table G- 6. Light transmission & haze test data – antireflective/conductive coating

Test Article ID	Total Luminous Transmittance	Diffuse Luminous Transmittance	Percent Haze
L-C6-C-1	94.5	0.35	0.37
L-C6-W1-1	94.4	0.69	0.73
L-C6-W1-2	94.3	0.75	0.8
L-C6-W1-3	94.3	0.79	0.84
L-C6-W2-1	91.5	13.27	14.5
L-C6-W2-2	93.3	9.33	10
L-C6-W2-3	93.2	8.35	8.96
L-C6-W3-1	89.1	39.74	44.6
L-C6-W3-2	89.1	43.04	48.3
L-C6-W3-3	89.4	37.73	42.2
L-C6-W4-1	89.6	25.8	28.8
L-C6-W4-2	89.8	37.45	41.7
L-C6-W4-3	89.1	35.02	39.3
L-C6-W5-1	91	12.65	13.9
L-C6-W5-2	90.3	10.66	11.8
L-C6-W5-3	90.9	10.82	11.9
L-C6-U1-1	94.2	0.37	0.39
L-C6-U1-2	94.3	0.22	0.23
L-C6-U1-3	94.1	0.23	0.24
L-C6-U2-1	94.2	0.19	0.2
L-C6-U2-2	94.2	0.12	0.13
L-C6-U2-3	94.1	0.39	0.41
L-C6-U3-1	94.1	0.18	0.19
L-C6-U3-2	94.1	0.17	0.18
L-C6-U3-3	94.1	0.29	0.31
L-C6-U4-1	94.3	0.19	0.2
L-C6-U4-2	94.3	0.26	0.28
L-C6-U4-3	94.1	0.24	0.26
L-C6-U5-1	94.1	0.2	0.21
L-C6-U5-2	94.2	0.24	0.26

Test Article ID	Total Luminous Transmittance	Diffuse Luminous Transmittance	Percent Haze
L-C6-U5-3	94.1	0.29	0.31
L-C6-U6-1	94.1	0.23	0.24
L-C6-U6-2	94.1	0.41	0.44
L-C6-U6-3	94	0.46	0.49

H LRU test photos

Table H- 1. Test photos for LRU 1

Check-In	
Pheno D- Fogging Method	
70% IPA – Wiping Method	Data Not Captured

Bactrokill + - Wiping Method	PREempt™ RTU – Wiping Method	Sani-Cide EX3 – Wiping Method
		

Table H- 2. Test photos for LRU 2

Check-In	
Pheno D – Fogging Method	
Calla® 1452 – Spraying Method	
Calla® 1452 – Wiping Method	

Table H- 3. Test photos for LRU 2

Check-In	
Calla® 1452 – Spraying Method	
Calla® 1452 – Wiping Method	

Table H- 4. Test photos for LRUs unit 4

Check-In	
Calla® 1452 – Spraying Method	
Calla® 1452 – Wiping Method	

I Data overview tables

Table I 1. Overview of LRU test results

Test	Application Method & Disinfectant						
	Wiping x1000					Spray x120	Fog x120
	70% IPA	Calla® 1452	Sani-Cide EX3	PREempt™ RTU	Bactrokill+	Calla®1452	Pheno D
Weight	No Significant Change	No Significant Change	No Significant Change	No Significant Change	No Significant Change	No Significant Change	No Significant Change
Visual	No Significant Change	Visible Residue; Local Discoloration and Oxidation; Label Damage	Visible Residue; Local Discoloration	No Significant Change	Local Discoloration and Oxidation	Visible Residue; Local Discoloration and Oxidation	Visible Residue
Functional (Mechanical Switches)	No Significant Change	Increased Friction on Toggle Switch	Increased Friction on Toggle Switch	No Significant Change	No Significant Change	Increased Friction on DUs Knob	No Significant Change
Functional (Simulator)	Failed Sim Check	Passed Sim Check	Failed Sim Check	Failed Sim Check	Failed Sim Check	Passed Sim Check	Failed Sim Check

Note. The red fill indicates a significant change was detected.

Table I 2. Overview of plastic and coating test result – wiping

Material Specifications	Wiping x1000				
	IPA (70%)	**Calla® 1452**	**Sani-Cide EX3**	**PREempt™ RTU**	**Bactrokill+**
Lexan™ 9600	Tensile DMA Weight Visual Flammability	Tensile DMA Weight Visual Flammability	Tensile DMA Weight Visual Flammability	Tensile DMA Weight Visual Flammability	Tensile DMA Weight Visual Flammability
Poly II acrylic (MIL-P-5425)	Tensile DMA Weight Visual Flammability	Tensile DMA Weight Visual Flammability	Tensile DMA Weight Visual Flammability	Tensile DMA Weight Visual Flammability	Tensile DMA Weight Visual Flammability
C1 (Antireflective/ Antiglare/ Oleophobic Coating A)	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle
C5 (Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A)	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle
C2 (Oleophobic Coating B)	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle
C3 (Oleophobic Coating C)	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle
C4 (Oleophobic Coating D)	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle
C6 (Antireflective/ Conductive Coating)	Weight Light Transmission & Haze Visual	Weight Light Transmission & Haze Visual	Weight Light Transmission & Haze Visual	Weight Light Transmission & Haze Visual	Weight Light Transmission & Haze Visual

Note. The red fill indicates a significant change was detected.

Table I 3. Overview of plastic and coating test result – UV-C round 1

Material Specifications	UV-C Exposures		
	Round 1		
	222 nm, 4 year duration	254 nm, 4 year duration	280 nm, 4 year duration
Lexan™ 9600	Tensile DMA Visual Flammability	Tensile DMA Visual Flammability	Tensile DMA Visual Flammability
Poly II acrylic (MIL-P-5425)	Tensile DMA Visual flammability	Tensile DMA Visual Flammability	Tensile DMA Visual Flammability
C1 (Antireflective/ Antiglare/ Oleophobic Coating A)	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle
C5 (Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A)	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle
C2 (Oleophobic Coating B)	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle
C3 (Oleophobic Coating C)	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle
C4 (Oleophobic Coating D)	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle
C6 (Antireflective/ Conductive Coating)	Weight Light Transmission & Haze Visual	Weight Light Transmission & Haze Visual	Weight Light Transmission & Haze Visual

Note. The red fill indicates a significant change was detected.

Table I 4. Overview of plastic and coating test result – UV-C round 2

Material Specifications	UV-C Exposures					
	Round 2					
	222 nm, 1 year duration	254 nm, 1 year duration	280 nm, 1 year duration	222 nm, 8 year duration	254 nm, 8 year duration	280 nm, 8 year duration
Lexan™ 9600		Tensile DMA Visual Flammability	Flammability	Tensile DMA Visual Flammability		Tensile DMA Visual
Poly II acrylic (MIL-P-5425)		Tensile DMA Visual Flammability	Tensile DMA Visual	Tensile DMA Visual Flammability		Flammability
C1 (Antireflective/ Antiglare/ Oleophobic Coating A)				Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle
C5 (Antireflective/ Antiglare/ Conductive/ Oleophobic Coating A)				Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle
C2 (Oleophobic Coating B)	Weight Light Transmission & Haze Visual Contact Angle				Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle
C3 (Oleophobic Coating C)	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle				Weight Light Transmission & Haze Visual Contact Angle
C4 (Oleophobic Coating D)	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle	Weight Light Transmission & Haze Visual Contact Angle			
C6 (Antireflective/ Conductive Coating)	Weight Light Transmission & Haze Visual	Weight Light Transmission & Haze Visual				Weight Light Transmission & Haze Visual

Note. The red fill indicates a significant change was detected. The diagonal line through the cell indicates that that material was not conditioned for that specific UV-C exposure configuration.