IIT Research Institute

Final Report No. IITRI-M06055-10

# EVALUATION OF THE EFFECTS OF SOLAR RADIATION ON GLASSES

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
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Attention: Mr. R. L. Nichols, EH-34

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## FOREWORD

The work described in this final report, IITRI-M06055-10, entitled "Evaluation of the Effects of Solar Radiation on Glasses," was performed under the sponsorship of the Marshall Space Flight Center. The work was conducted under Contract No. NAS8-33388 over the period July 9, 1979 to December 31, 1980, at IIT Research Institute. Mr. Y. Harada was the principal investigator on this program. We are pleased to acknowledge the valuable assistance and counsel of Mr. R. L. Nichols, NASA/Marshall Space Flight Center Contracting Officer's Representative on this program.

Respectfully submitted,
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## 1. INTRODUCTION

The space environment to be encountered by space vehicles is extremely complex, involving particulate as well as ultraviolet radiation. The penetrating radiation environment may result from a variety of sources of which the most important are probably cosmic radiation, trapped radiation, auroral radiation, and solar flare radiation. It is possible that such high energy protons and electrons will have a more significant effect than ultraviolet on spacecraft materials such as glasses, and that synergistic effects from the variety of radiations will occur.

A wide variety of functions must be performed by glass components on a space structure, ranging from windows for simple viewing in the visible wavelength region, to lenses for ir detection devices which must transmit at much higher wavelengths. Thus, radiation damage must be evaluated with a view toward the particular application. For example, many infrared-transmitting materials have been darkened to near opaqueness in the visible region, but the ir transmission remains virtually unaffected so that the functionality is maintained.

In a recent program conducted at IITRI,[1] studies were conducted to evaluate the degradation of glass due to electromagnetic and particulate radiation in a space environment. Initial work was concerned with attempts to define the space environment. Secondly, a literature review was made on radiation damage mechanisms in glasses. Four optical materials were exposed to simulated solar and particulate radiation in a space environment. Sapphire and fused silica experienced little change in transmittance while optical crown glass and ultra low expansion glass darkened appreciably.

The objective of the current program was to carry this technology further by achieving a more complete analysis of the 500 hour simulated space exposure test. Additionally, studies were conducted to aid in sample selection for a 100 hour simulated exposure test.

## 2. TECHNICAL BACKGROUND

Current materials for space applications must endure increasingly stringent environments as missions are displaced outward from near-earth orbits, and are designed for longer durations of several years. In a synchronous equatorial orbit, for example, electrons and protons as well as ultraviolet radiation are considered to be prime contributors to spacecraft surface materials degradation.[2] The ramifications for glass materials are discussed in the following sections.

### 2.1 SPACECRAFT OPTICAL MATERIALS

The materials used aboard spacecraft for optical applications are in general those which transmit in the solar spectrum, nominally from 200 nm to 3000 nm. For the 200-1000 nm regions, silicon oxide based materials, notably fused silica of high purity, have found widest application. The selection of suitable optical materials, however, involves not only initial optical properties, but optical stability, mechanical properties and performance, contamination potential, contaminability, electrical properties, rf transparency, and, of course, cost.

From a materials point of view, there are three regions of optical interest: UV (< 300 nm), visible (300-700 nm), and near ir (> 700 nm). For UV applications, silica appears optimum, although some alkali halides might be considered; in any UV applications, inorganic materials are almost mandatory. Visible region applications quite probably can utilize organic-based transparencies, except there UV transparency is also essential. Infrared applications--both traditionally and, quite logically, from materials initial properties and space stability considerations--have required inorganic materials. Organic materials inevitably exhibit either ir "fingerprint" spectra, poor mechanical properties, or other objectional properties. Simply stated, the primary criteria for selection of spacecraft optical materials are initial properties, environmental stability, and mechanical/physical/environmental considerations. Only one region, the visible, was investigated on the IITRI program, and the materials were all inorganic oxides.[1] These are discussed in a later section.

For spacecraft use, in general, standard radiation resistant optical materials are sapphire and Corning 7940 fused silica glass. These are used for the front elements of optical systems whenever possible. If other materials must be used, a 2-3 mm thick fused silica glass window is used in front of the optical components. The window eliminates almost 90% of the particulate radiation and also the very short wavelength ultraviolet. If a window cannot be used, then the equipment is designed to compensate for the degradation. For example, solar cell cover glass, Corning 0020, degrades approximately 5% in one year when exposed directly to solar radiation. Hence, for a one-year mission, the cell is designed to have an initial output which is 5% greater than required.

## 2.2 SPACE ENVIRONMENT DEFINITION

The highly complex and dynamic nature of a space environment demands in-situ and current data for good definition. This type of information is best obtained from a source such as the Goddard Space Flight Center which continually monitors and analyzes such data. IITRI in its previous program established a dialogue with Mr. E. G. Stassinopoulis, Senior Acquisition Scientist, Radiation Environment, NASA/Goddard Space Flight Center.

Mr. Stassinopoulis pointed out that the space environment near the earth was extremely variable, both spacially and temporally. Photon radiation remains relatively constant at 1 sun, but particulate radiation, which is mainly protons and electrons, strongly depends on the orbit of the spacecraft and the solar activity during the time in orbit.

The space environment in which the glasses are to be used was also discussed with Mr. R. Nichols and Mr. J. Wright, Astrophysics, and with Mr. P. Priest, Space Programs, NASA/Marshall Space Flight Center.

The conclusion from these discussions was that average conditions should be selected for initial simulated solar radiation experiments. Later experiments could then be designed to explore the effect of variations from average.

## 3. RESULTS AND DISCUSSION

The current program was concerned with evaluation of a space simulation test of optical materials for spacecraft and with determination of materials anticipated for use in future space missions. The results are discussed in the following sections.

### 3.1 GLASS MATERIALS

In current technology, sapphire or fused silica glass appear to be the best materials available for resisting optical degradation in an ultraviolet/particulate radiation environment. In establishing glass materials for testing the following ranking of resistance to radiation damage was developed:

1. Excellent - sapphire
2. Good - fused silica
3. Fair - optical crown glass
4. Poor - ultra low expansion glass

These materials were chosen for exposure for the following reasons:

1. Sapphire is exceptionally strong and hard (9 on the Mohs scale) and is by all reports the best material for resisting radiation damage. Union Carbide Czochralski grown sapphire crystals were chosen.

2. Fused silica is a close second to sapphire in strength and hardness (7 on the Mohs scale) and in radiation resistance, and has been used on numerous space missions. Corning 7940 synthetic fused silica was chosen because it is a well-characterized, uniform material with very low solar absorptance.

3. Optical crown glass is used in many optical devices as the front element of the objective lens. It was observed to darken when exposed directly to the space environment in Spacelab experiments. Shott BK-7 was chosen since it is the most widely used glass of this type and readily available.

4. Ultra low expansion glass is a very interesting optical material which is almost immune to thermal shock failure. Windows made of this material could be used without failure for observation during the thermal heating caused by reentry. Corning 7971 was chosen because it was readily available.

Specimens were obtained directly from the manufacturer. The sapphire specimens were obtained from the Crystal Products Division of Union Carbide Corporation as standard optical windows, 25.4 mm diameter and 2 mm thick. The optical glass specimens were also standard windows, 25.4 mm diameter and 3 mm thick, obtained from Melles Griott, Inc., Irvine, California. The fused silica and ultra low expansion glasses were obtained from the Corning Glass Works as rough cut discs which were then ground and polished to 25.4 mm diameter and 3 mm thick.

All the specimens were made of commercially produced materials. Standard industrial pitch polishing procedures were used to produce specimens which were flat within 1/4 wavelength of light per 25 mm, parallel within 30 seconds of arc, and surface quality of 80-50 scratch and dig.

Samples were cleaned, and approximately one half of the surface of each sample was coated with aluminum and then with silica by vacuum evaporation. The coating provided a back surface mirror for transmission optical measurement by double reflection.

The samples of the selected glasses were furnished to Boeing Aerospace Corporation, who conducted the simulated exposure. Brief descriptions of the glasses, the number of specimens supplied, and the number of each type put into the exposure array, are indicated in Table 1.

TABLE 1. WINDOW MATERIALS FOR SPACE SIMULATION STUDIES

| Glass Type | Number Supplied | Number Tested |
|---|---|---|
| 7971 (low expansion glass) | 3 | 2 |
| BK-7 (crown glass) | 3 | 2 |
| 7940 (fused silica) | 2 | 1 |
| Sapphire (alpha-alumina) | 2 | 1 |

## 3.2 TEST SIMULATION CONDITIONS

Test irradiation parameters were determined on discussions with NASA/Marshall and NASA/Goddard personnel, and were as follows:

1. Solar UV--one sun intensity, assuming earth orbit and air mass zero conditions; 0.2 0.4 micrometer spectral content from xenon arc continuum; infrared $\lambda > 1.4$ micrometer suppressed by water column around xenon arc.
2. Vacuum UV--one sun intensity at hydrogen Lyman-$\alpha$ wavelength (1216 Å); radiation introduced into chamber through the VUV source's window.
3. Electrons--intensity (flux) $1 \times 10^9$ e/cm$^2$-sec, at 50 KeV energy.
4. Protons--intensity $1 \times 10^9$ p/cm$^2$-sec, at 30 KeV energy; introduced into chamber after magnetic bending to separate mass-one ($H^+$) from $H_2^+$ and other species.
5. Temperature--20°C for all test samples.
6. Vacuum--average of at least $5 \times 10^{-8}$ torr during exposure, and $2 \times 10^{-8}$ torr during spectral reflectance measurement periods.

## 3.3 TEST SIMULATION FACILITIES

The space simulation test was conducted at the Boeing Aerospace Corporation. A description of their facilities is presented in Appendix A. During the course of this program, a visit was made to the facilities at TRW in Redondo Beach, California. A tour of the space environmental systems laboratory was made through the courtesy of Mr. G. Brown. These laboratories are described in the literature in Appendix B.

## 3.4 SPACE SIMULATION EFFECTS ON GLASSES

Examination of the specimens immediately after 503 hours of exposure showed that the optical glass and ultra low expansion glass specimens had darkened appreciably. All specimens were physically intact after exposure and had not suffered any gross mechanical damage. Heating and charge buildup during exposure was probably very small, since the specimens were in good thermal and electrical contact with the water-cooled copper support.

Graphs of the absolute reflectance data for representative specimens are shown in Fig. 1 (sapphire) and Fig. 2 (low expansion glass). In each of these figures the uppermost data curve was obtained before exposure began. Small reflectance changes were measured at each subsequent measurement point, with the 503-hour data being represented by the lowest curve. Tabular data of reflectance values vs. wavelength for the various samples at the different levels of exposure are contained in Appendix C.

The computer program also calculated solar absorptance coefficients ($\alpha_s$) corresponding to each measurement. These are tabulated below.

TABLE 2. SOLAR ABSORPTANCE CHANGES IN SPACE SIMULATION STUDIES

| | Solar Absorptance Coefficient | | | | | |
|---|---|---|---|---|---|---|
| | Pre-Irrad | After Exposure for | | | | Increase Af[illegible] |
| Sample | in Vacuum | 50 hr | 154 hr | 313 hr | 503 hr | 503 hr |
| Sapphire | 0.109 | 0.112 | 0.110 | 0.115 | 0.118 | 0.009 ( 8.[illegible]%) |
| Crown No. 3 | 0.094 | 0.106 | 0.109 | 0.114 | 0.118 | 0.024 (25.5%) |
| Crown No. 2 | 0.098 | 0.109 | 0.111 | 0.117 | 0.119 | 0.021 (21.4%) |
| Low exp. No. 1 | 0.085 | 0.092 | 0.094 | 0.101 | 0.108 | 0.023 ([illegible]) |
| Low exp. No. 2 | 0.083 | 0.088 | 0.090 | 0.097 | 0.108 | 0.020 ([illegible]%) |
| Fused Silica | 0.078 | 0.080 | 0.081 | 0.088 | 0.087 | 0.009 (11.4%) |

The change in the absorptance of the sapphire and fused silica specimens was very small and close to the limit of accuracy of the measurements.

A plot of these $\alpha_s$ values against exposure time (Fig. 3) shows that sapphire and fused silica have no pronounced initial increase in $\alpha_s$ but, rather, have a somewhat regular $\alpha_s$ increase rate. On the other hand, the

S-1

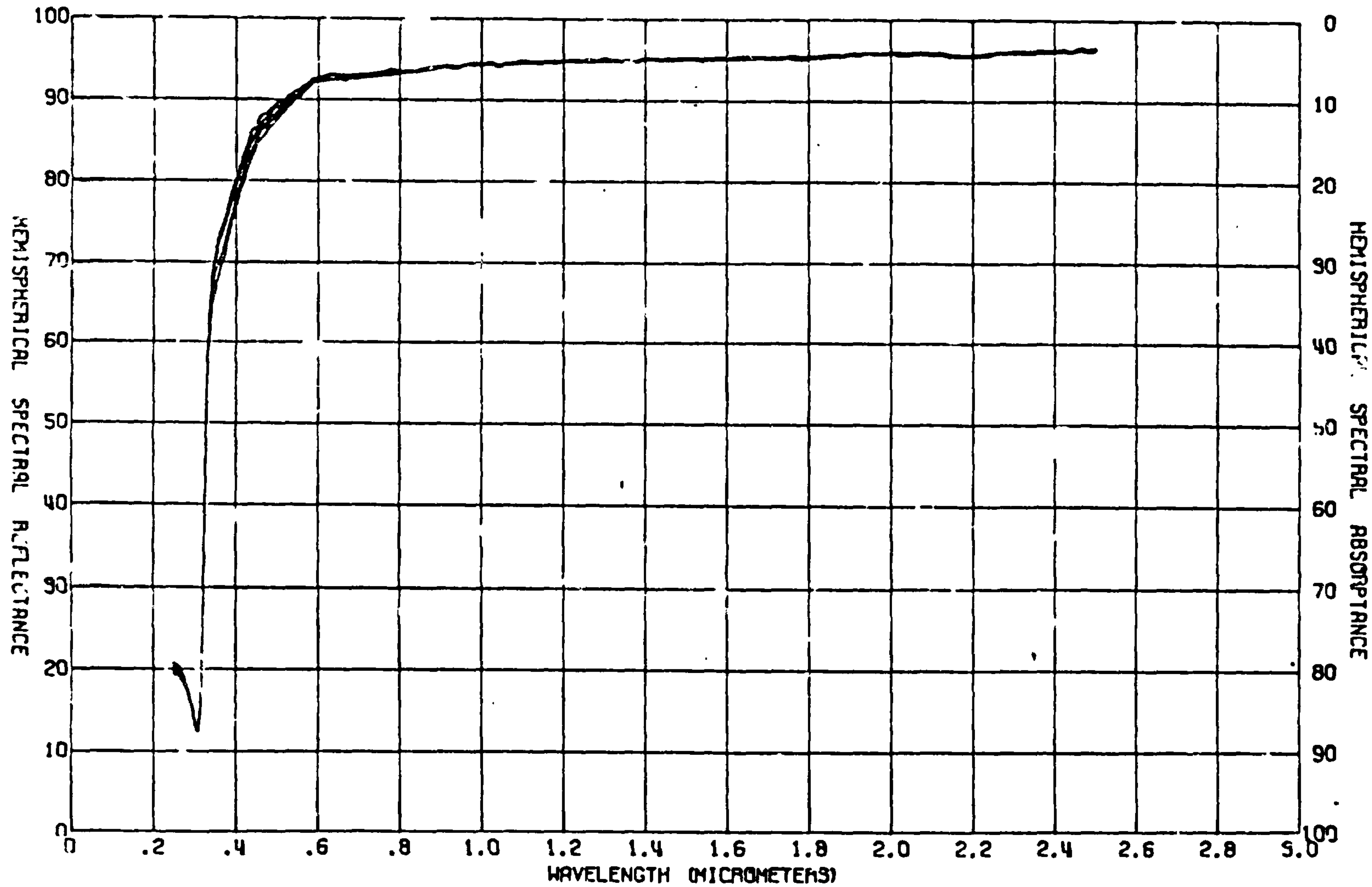


Figure 1. Effect of real-time solar UV, vacuum UV, protons, and electrons on the reflectance of sapphire in situ.

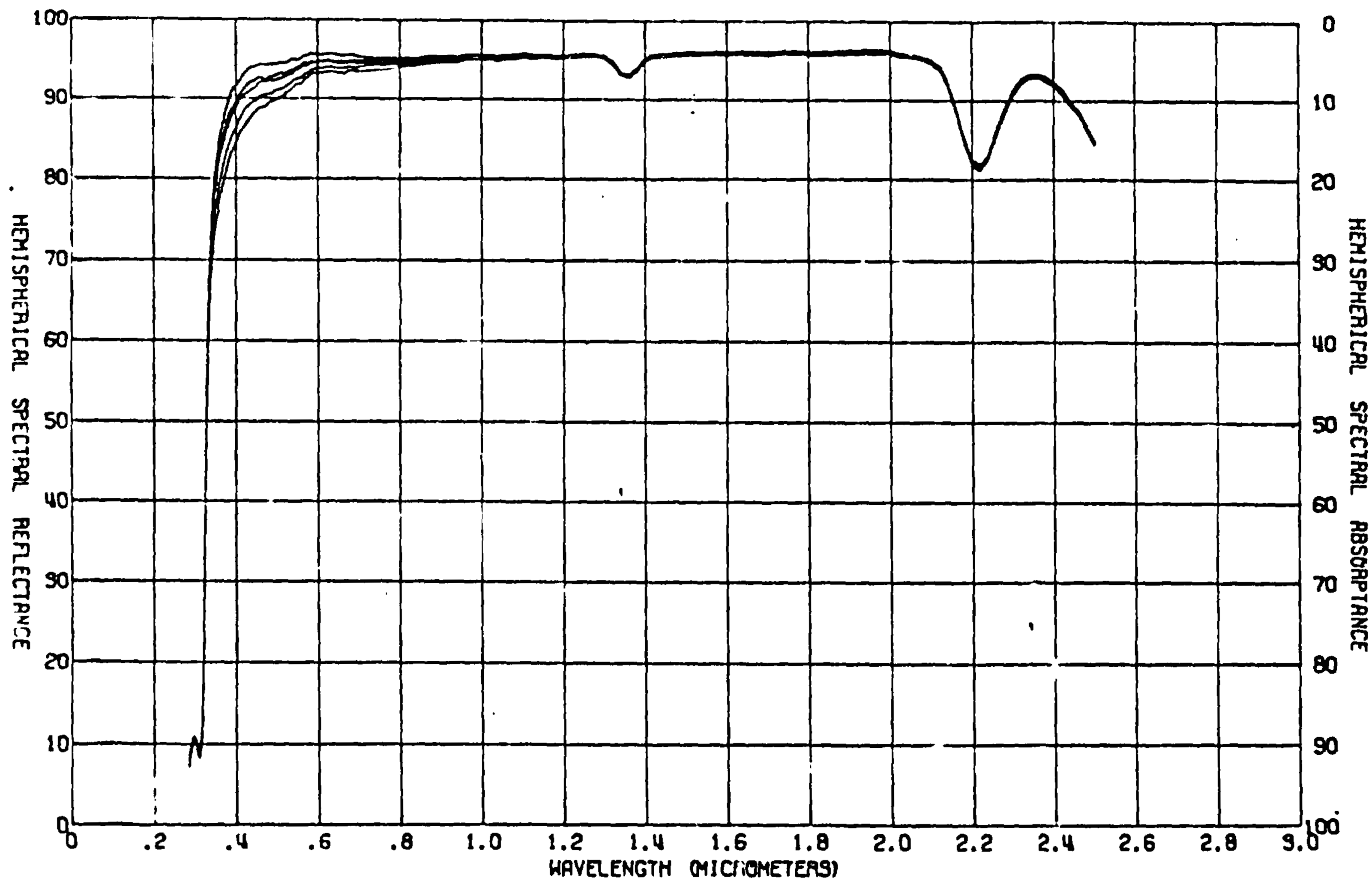


Figure 2. Effect of solar UV, vacuum UV, protons, and electrons on the reflectance of 7971 low expansion glass in situ.

crown glass samples and the low expansion glass samples underwent larger initial increases in $\alpha_s$ that tapered to slower rates of increase.

Examination of the reflectance curves before and after various exposure times did not reveal the appearance of any new absorption regions. Rather for all specimens there was an increase in absorption with exposure time, particularly at the fundamental absorption edge in the near UV. Examination of the more detailed digital data in Appendix C, also did not reveal any particular pattern in reflectance changes. The absorptions at 1.3 and 2.2 micrometers of the glasses relate to the silica network and was most pronounced in fused silica. Sapphire being alumina did not, of course, show these. It was surprising that the modifiers present in the optical glass and ultra-low expansion glass did not result in new absorptance regions after exposure, although they do suppress the silica regions in optical glass.

The change in solar absorptance values with time which was tabulated in the previous section and shown in Fig. 3, indicate that the *a priori* ranking of the optical materials was correct. Sapphire is the most stable material followed closely by fused silica, while crown optical glass and ultra-low expansion glass show stronger degradation. For some applications fused silica may be preferred because of its lower initial absorption,since even after 503 hours of exposure it was still less than sapphire. The optical glass and ultra low expansion glass,on the other hand, while reasonably stable for 503 hours, may have limited usefulness for very long space missions. However, the utility of any optical materials will be determined by the particular mission requirements.

Other analytical methods which were examined were thermoluminescence and changes in microhardness. The measurement of microhardness was used in an attempt to determine any change in mechanical integrity. No significant differences were observed for exposed (500 hr simulated exposure) vs. virgin materials. Apparently this test is not sensitive enough to show changes (if any) in the bonding of these glasses. Thermoluminescence measurement was thought to be another potential analytical method. However, it was determined that the assembly of the needed equipment,along with performing of such experiments, was beyond the financial scope of this program.

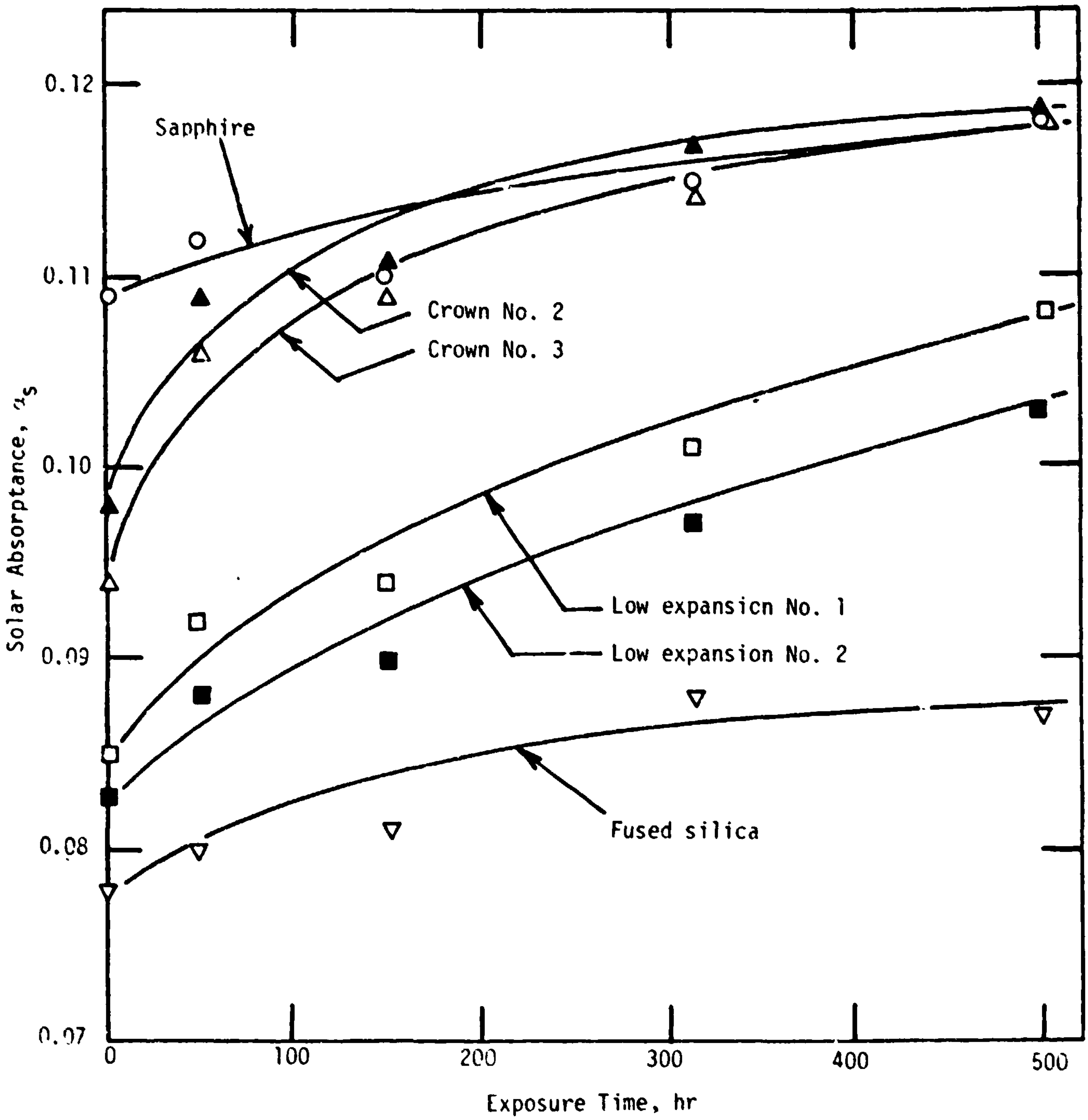


Figure 3. Solar absorptance vs. exposure time to simulated space environment for glass materials

## 3.5 SPACECRAFT GLASS MATERIALS: STATE-OF-THE-ART

Dialogue with engineers involved with spacecraft materials was carried on during this program. People who have been contacted include: Bill Carroll (JPL), Carl Maag (JPL), Larry Fogdall (Boeing), Gene Rusert (McDonnell Douglas), Mel Clancy (Rockwell), Al Rubin (Aerojet), and Jerry Brown (TRW). The consensus appears to be that fused silica is acceptable for all current missions including those in synchronous orbit. Problems or potential problems of any significance with glass materials have not yet surfaced.

Examples of glass material laminates used for viewing windows in spacecrafts are shown in Fig. 4. This information was supplied by Mr G. Rusert of McDonnell Douglas which was responsible for these spacecraft.

SPACE ENVIRONMENT

↑

| | | |
|---|---|---|
| 0.330 in. | C7913 Vycor | Used on Mercury and Gemini spacecraft |
| 0.380 in. | C7913 Vycor | |
| 0.223 in. | C1723 Tempered Aluminosilicate | |

SPACE ENVIRONMENT

↑

| | | |
|---|---|---|
| 0.420 in. | C7913 Vycor | Used on airlock module for Apollo-Manned orbiting laboratory |
| 0.240 in. | C1723 Aluminosilicate | |

Figure 4. Spacecraft Windows

## 4. CONCLUSIONS AND RECOMMENDATIONS

Additional studies were conducted in this program in an effort to extract additional information from the results of a 500 equivalent hours space simulation experiment. These studies have shown the following:

1. Changes in reflectance spectra do not show any significant differences in absorption peaks which could be used to indicate degradation mechanisms. It is possible that the test period was too short to produce any such differences.
2. No significant changes were observed in microhardness of glass samples due to UV-vacuum-particulate irradiation.
3. Longer term testing is needed in order to obtain information applicable to longer term space missions of up to 10 years.
4. Fused silica and "Vycor," a high-silica (96%) glass, appear to be the preferred glass materials for viewing windows on spacecraft. Among the people interviewed with interests in this area, no significant problems were apparent.
5. For any future tests, the Boeing and TRW space simulation laboratories would appear to be significantly different.

## REFERENCES


1. Firestone, R. F., and Harada, Y., "Evaluation of the Effects of Solar Radiation on Glass," IITRI Final Report No. D6139 for NASA/Marshall Space Flight Center (January 1979).

2. Kurland, R. M., et al., "Properties of Metallized Flexible Materials in the Space Environment," Final Report, SAMSO TR 78-31, TRW/Defense and Space Systems Group (January 1978).

3. Zerlaut, G. A., Harada, Y., and Tompkins, E. H., "Ultraviolet Irradiation in Vacuum of White Spacecraft Coatings," in Symposium on Thermal Radiation of Solids, NASA SP-55, Scientific and Technical Information Division, Washington, D.C., pp. 391-420 (1965).

# APPENDIX A

Radiation Effects Laboratory
Boeing Aerospace Company
Seattle, Washington 98126

## RADIATION EFFECTS LABORATORY
## BOEING AEROSPACE COMPANY

The simulated space exposure for this program was performed in a facility at Boeing known as the combined radiation effects test chamber (CRETC). This facility was originally designed after completion of a number of years of testing thermal control coatings for government and corporate customers. It has as high a quality of simulation of the space radiation environment as knowledge and the state-of-the-art will allow. Exposure capabilities include electron radiation and Lyman-α vacuum ultraviolet sources in addition to the usual proton accelerator and solar simulator.

The space simulation capabilities of the CRETC facility can be summarized as follows:

1. Continuum ultraviolet radiation (xenon arc discharge) at selectable intensities ranging from less than one solar constant to 20 solar constants (1 AU), simultaneously with:
2. Electrons with energies between approximately 10 eV and 200 keV and/or protons with energies from 0.5 to 85 KeV (kilo electron volts). Electrons of greater than $\sim$15 KeV are foil-scattered; protons are magnetically analyzed.
3. Vacuum ultraviolet radiation (VUV), primarily the Lyman-α wavelength of 1216 Å, from a contained discharge (no introduction of contamination into vacuum chamber). Intensity selectable up to and above one VUV sun at 1216 Å at 1 AU.
4. Controlled temperatures for test and reference (standard) samples; temperatures range from

-195°C (-320°F) to +180°C (+360°F). Temperature control is not interrupted for measurements in the chamber's integrating sphere.

5. Vacuum pumping (both rough and final) without resorting to organic and other contaminating fluids. The sequence used is (a) dry nitrogen gas aspiration, (b) cryo-sorption, (c) large-surface $LN_2$ cryogenic, and (d) ion pumping, to obtain a $5 \times 10^{-8}$ torr vacuum before testing begins.

6. Extensive automation, interlocks, and sequential shutdown procedures during unmanned night-time operations, to allow as high a reliability as possible during long-term, continuous testing.

7. High-precision spectral reflectance data system with in-situ integrating sphere and double-beam spectrophotometer coupled to a data-logging module whose output is ready for computer processing.

8. Residual gas analysis from 1-100 amu with scan rates down to 0.1 sec/scan and minimum partial pressure detectability of $2 \times 10^{-11}$ torr.

9. Electrical discharge event counter with relative magnitude indication.

The CRETC utilizes an integrating sphere reflectometer with detectors in situ. Only the measurement light sources, monochromator, and electronic and light chopping apparatus are external to the chamber. Sample reflectance measurements are made relative to the reflectance of the integrating sphere's magnesium oxide wall. Normalization to absolute reflectance (derived from National Bureau of Standards and other known reference measurements) is handled by computer since all original sample data are computer-processed routinely.

The thermophysical property of chief interest for this program, solar absorptance, is derived from solar reflectance, which is defined as

$$\text{Solar reflectance, } R_s = \frac{\int I_s(\lambda)R(\lambda)d\lambda}{\int I_s(\lambda)d\lambda}$$

where $I_s(\lambda)$ is the solar irradiance as a function of wavelength $\lambda$, and $R(\lambda)$ is sample reflectance, generally a function of $\lambda$. By measuring the reflectance of transmissive glasses with a suitable metal backing (aluminum), double sensitivity to radiation-induced changes is obtained. The measurement beam passing through the integrating sphere makes a double-pass through the sample, yielding a measurement proportional to change in transmission squared. This allowed a more exact determination of damage in the various optical quality glasses studied and compared during this program. In practice, change in transmission generally will be found to be half the measured change in reflectance.

Radiation dosimetry systems are integral to the CRETC, and operating personnel have long-time experience in obtaining the pertinent irradiation and exposure parameters. Faraday cups and tabs are both employed for measuring oncoming particle radiation beams at the sample plane.

For ultraviolet radiation parameters, sun rates are determined from radiometer output levels taken with and without a UV-absorbing filter over the radiometer detector. Since the UV-absorbing filter also excludes ten percent of the incident radiation at wavelengths longer than the ultraviolet (five percent reflection at each surface of the filter), a correction is made for radiometer readings taken with the filter over the radiometer sensor. For a total radiation reading T and a UV-filtered reading F,

$$\text{Ultraviolet Sun rate} = \frac{T - \frac{10}{9}F}{(8.0)\ (0.091)} = 1.37\ (T - 1.11\ F),$$

where 8.0 is the radiometer sensitivity in millivolts per incident sun ($\approx$0.14 watts/cm$^2$) and 0.91 represents the ultraviolet content of the sun (at air mass zero). The uniformity of ultraviolet radiation intensity across the sample array is determined by "mapping" with the radiometer held in a precise jig.

Spatial uniformity of ultraviolet radiation can be maintained within plus or minus 10 percent across the sample array. The F and T values indicate that the ultraviolet content of the long-arc xenon sources is approximately 10 percent of their total input. Characteristic of all xenon arcs, the shape of this ultraviolet content is somewhat more steep than the sun at air mass zero (AMO).

APPENDIX B

SPACE ENVIRONMENT SIMULATION LABORATORY
TRW Defense and Space Systems Group
Redondo Beach, CA 90278

# **TRW** - DSSG SPACE ENVIRONMENT SIMULATION LABORATORY

TRW DSSG-Vulnerability and Hardness Laboratory of the Advanced Technology Division in conjunction with the Engineering Laboratory of the Space Systems Division operates a Space Environmental Systems Laboratory for the use of external as well as in company users.

The laboratory is located in TRW DSSG *BUILDING 84* at 14520 Aviation Boulevard, in Lawndale, California in close proximity to the main TRW DSSG complex in Redondo Beach, California.

The original design of this laboratory was primarily directed towards the study of optical and mechanical property degradation of relatively thin film materials, solar cells, and other structural elements of spacecraft directly exposed to the natural space environment.

A view of the laboratory in one configuration is shown in *Figure 1*. A number of vacuum irradiation stations/chambers are arranged around a 1.2 MV Van de Graaff electron accelerator in an irradiation vault. The electron beam from the accelerator can be directed into each of the chamber positions using a switching magnet and solenoidal focusing magnets. Each chamber is provided with additional simulation sources for simultaneous operations. The diversity of these sources is tabulated in *Table I*. *Table II* shows the capabilities which presently exist at each chamber position.

Each chamber has an available capacity of 18 inches diameter by 30 inches long. All are pumped by at least 400 l/sec vac-ion pumps. The "in-situ" optical chamber and "ex-situ" mechanical test chamber are also pumped by titanium sublimation pumps. The chambers can be easily modified for other types measurements because of the large number of instrumentation/entry ports available on each.

*Figure 2(a)* and *(b)* gives the simulation spectral capability of the ultraviolet sources in use. As listed in the table the "near" ultraviolet capability is available presently for all three chambers while the far ultraviolet capability is available only at the 60° position.

The laboratory is designed for continuous semi-automated operation. At present all systems and environments can be operated unattended except the Van de Graaff system which is being modified to allow unattended operation of it as well. During such operations key parameters are checked periodically and the latest data is available for remote telephone readout on demand. Out of limit key parameters can be alarmed to a central security system from whence repair personnel can be located immediately by beeper.

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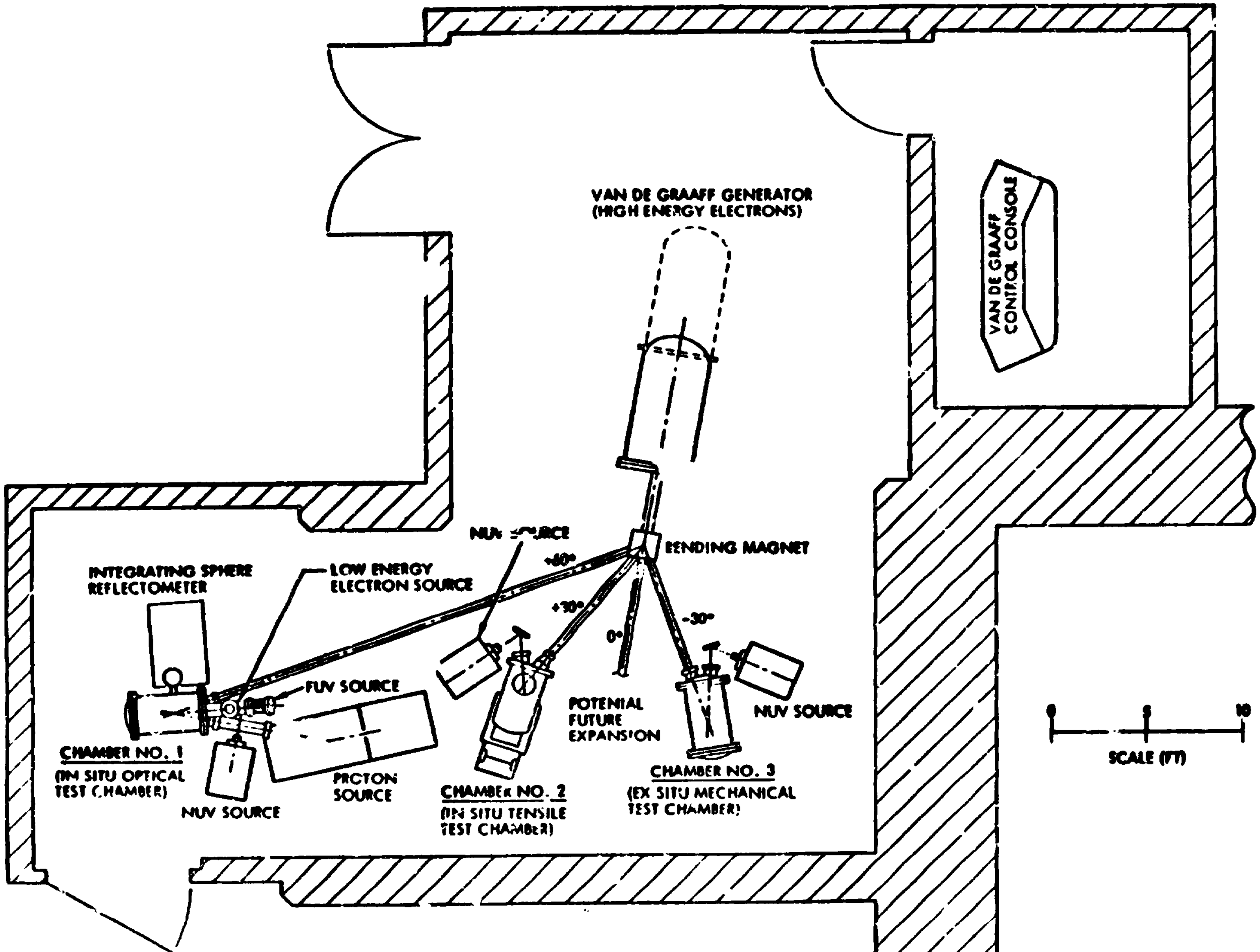
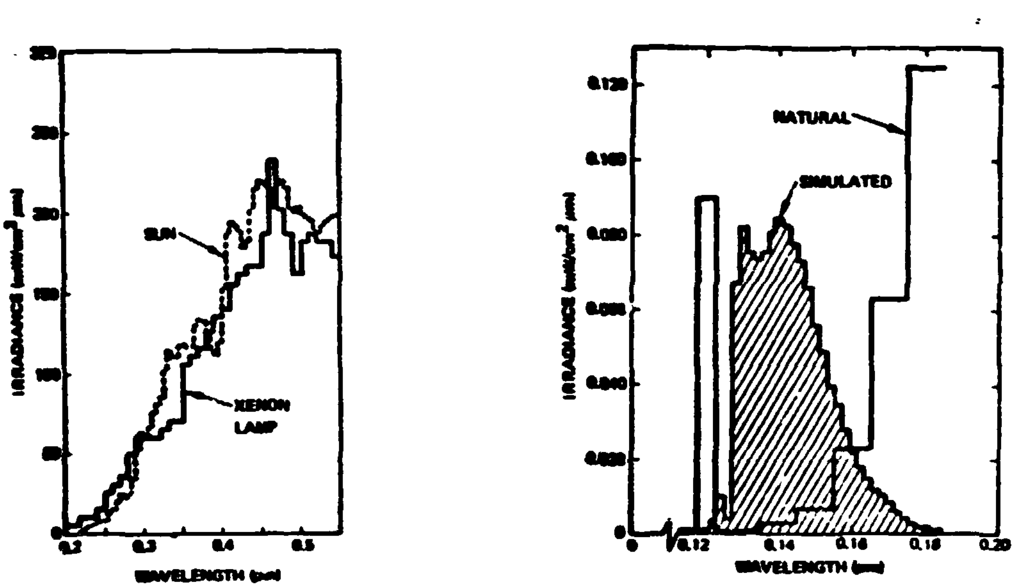



*Figure 1* - SPACE ENVIRONMENTAL SIMULATION LABORATORY (SESL) LAYOUT

*Table I* - ENVIRONMENTAL SIMULATION DESCRIPTION

| Radiation Component | Simulated Radiation Source | Simulation Source Characteristics |
|---|---|---|
| Near Ultraviolet | 3-KW Short Arc Xenon Lamp | 0.18 to 0.40 $\mu$m<br>Up to 5X Sun Intensity |
| Far Ultraviolet | Electrodeless Krypton Gas Lamp | 0.10 to 0.18 $\mu$m<br>Up to 5X Sun Intensity |
| Radiation Belt Electrons | Van de Graaff Accelerator | 50 keV to 1 MeV<br>$10^7$ to $10^{11}$ e/cm$^2$ sec |
| Plasma Sheet Electrons | Electron Flood Gun | 0.5 to 10 keV<br>Up to $10^{11}$ e/cm$^2$ sec |
| Radiation Belt Protons | Ionization Equivalent Electrons From Van de Graaff Accelerator | 50 keV to 1 MeV<br>$10^7$ to $10^{11}$ e/cm$^2$ sec |
| Solar Flare Protons | Ionization Equivalent Electrons From Van de Graaff Accelerator | 50 keV to 1 MeV<br>$10^7$ to $10^{11}$ e/cm$^2$ sec |
| Plasma Sheet Protons | Hydrogen Ion Plasma Generator | Up to 30 keV<br>Up to $10^{11}$ p/cm$^2$ sec |
| Vacuum | $GN_2$ Aspiration, Cryosorption, and 400 ℓ/sec Ion Pumping | $10^{-6}$ to $10^{-8}$ Torr |




a) Near Ultraviolet Source

b) Far Ultraviolet Source

*Figure 2* - SPECTRAL ENERG[illegible]ION OF ULTRAVIOLET SOURCES

*Table II* - LABORATORY CAPABILITIES

| Test Station | Environment | Sample Capability | In-Situ Measurement |
|---|---|---|---|
| In-Situ Optical (60°) | Ultraviolet (0.10-0.40 um)<br>Protons (1-30 keV)<br>Electrons (1-10 keV)<br>Electrons (50-1000 keV)<br>Vacuum (to $5\times10^{-8}$T)<br>Temperature (to -100° C) | 24 pc (1x2 cm)<br><br>4 contamination witness plates | Dir. Spectral Reflectance<br>Dir. Diffuse Reflectance<br>Bidirectional Reflectance<br><br>Specimens removed for total emmittance measurements. |
| In-Situ Tensile (30°) | Ultraviolet (0.18-0.40 μm)<br>Electrons (50-1000 keV)<br>Vacuum (to $5\times10^{-8}$T)<br>Temperature (to -70° C) | 17 pc (1 in. gage length by ½ in. width) | Tensile Stress-strain to 2% strain level.<br>Tensile Stress-strain to failure. |
| Solar Cell Test (0°) | Electrons (50-1000 keV)<br>Temperature (to -20° C) | 12 pc (1x2 cm) | Specimens removed for characteristics testing. |
| Ex-Situ Mechanical (-30°) | Ultraviolet (0.18 to 0.40 μm)<br>Electrons (50-1000 keV)<br>Vacuum (to $5\times10^{-8}$T)<br>Temperature (to -100° C) | 40 pc (1 in. gage length by ½ in. width) | Specimens removed to dry nitrogen for tensile testing. |

Additional information may be obtained by calling R. Kurland- 213/535-1916 or W. Beggs- 213/536-3135.

Tours of the facility can be arranged through the Building Operations Manager, P. Guilfoyle- 213/535-0056.

## APPENDIX C

## REFLECTANCE VS. WAVELENGTH DATA
500 Hour Space Simulation Experiment

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, K-3 23 AUG 78 100140001

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU IN VACUUM, BEFORE EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0,094

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0,230 | 0,0 | 0,232 | 0,0 | 0,234 | 0,0 | 0,236 | 0,0 | 0,238 | 0,0 |
| 0,240 | 0,0 | 0,242 | 0,0 | 0,244 | 0,0 | 0,246 | 0,0 | 0,248 | 0,0 |
| 0,250 | 6,0 | 0,252 | 6,0 | 0,254 | 6,0 | 0,256 | 6,0 | 0,258 | 6,1 |
| 0,260 | 6,0 | 0,262 | 6,0 | 0,264 | 6,0 | 0,266 | 5,9 | 0,268 | 5,9 |
| 0,270 | 6,0 | 0,272 | 5,9 | 0,274 | 5,8 | 0,276 | 5,7 | 0,278 | 5,7 |
| 0,280 | 5,7 | 0,282 | 5,7 | 0,284 | 5,7 | 0,286 | 5,6 | 0,288 | 5,6 |
| 0,290 | 5,7 | 0,292 | 5,7 | 0,294 | 5,7 | 0,296 | 5,8 | 0,298 | 5,9 |
| 0,300 | 6,0 | 0,302 | 6,2 | 0,304 | 6,2 | 0,306 | 6,3 | 0,308 | 6,6 |
| 0,310 | 6,7 | 0,312 | 7,0 | 0,314 | 7,7 | 0,316 | 8,8 | 0,318 | 10,7 |
| 0,320 | 13,6 | 0,322 | 18,3 | 0,324 | 24,3 | 0,326 | 31,9 | 0,328 | 39,4 |
| 0,330 | 46,5 | 0,332 | 52,6 | 0,334 | 57,3 | 0,336 | 60,8 | 0,338 | 64,8 |
| 0,340 | 67,7 | 0,342 | 70,5 | 0,344 | 72,2 | 0,346 | 74,4 | 0,348 | 75,9 |
| 0,350 | 77,2 | 0,352 | 78,5 | 0,354 | 80,0 | 0,356 | 81,1 | 0,358 | 83,1 |
| 0,360 | 84,1 | 0,365 | 85,9 | 0,370 | 86,9 | 0,375 | 88,2 | 0,380 | 89,5 |
| 0,385 | 91,0 | 0,390 | 91,8 | 0,395 | 92,1 | 0,400 | 92,7 | 0,405 | 92,6 |
| 0,410 | 93,2 | 0,415 | 93,4 | 0,420 | 93,7 | 0,425 | 93,5 | 0,430 | 93,9 |
| 0,435 | 93,9 | 0,440 | 94,2 | 0,445 | 93,7 | 0,450 | 93,8 | 0,455 | 94,0 |
| 0,460 | 94,2 | 0,465 | 93,9 | 0,470 | 93,8 | 0,475 | 93,4 | 0,480 | 94,1 |
| 0,485 | 93,7 | 0,490 | 93,9 | 0,495 | 93,8 | 0,500 | 94,1 | 0,505 | 94,3 |
| 0,510 | 93,9 | 0,515 | 94,3 | 0,520 | 93,8 | 0,525 | 94,3 | 0,530 | 94,5 |
| 0,535 | 94,6 | 0,540 | 94,5 | 0,545 | 94,4 | 0,550 | 94,4 | 0,555 | 94,8 |
| 0,560 | 94,5 | 0,565 | 94,8 | 0,570 | 94,8 | 0,575 | 94,6 | 0,580 | 94,8 |
| 0,585 | 94,8 | 0,590 | 94,7 | 0,595 | 94,5 | 0,600 | 94,6 | 0,605 | 94,5 |
| 0,610 | 94,5 | 0,615 | 94,6 | 0,620 | 94,6 | 0,625 | 94,7 | 0,630 | 94,6 |
| 0,635 | 94,6 | 0,640 | 94,7 | 0,645 | 94,9 | 0,650 | 94,7 | 0,655 | 94,5 |
| 0,660 | 94,8 | 0,665 | 94,7 | 0,670 | 94,9 | 0,675 | 94,8 | 0,680 | 94,9 |
| 0,685 | 94,6 | 0,690 | 94,8 | 0,695 | 94,7 | 0,700 | 94,9 | 0,720 | 95,0 |
| 0,740 | 95,0 | 0,760 | 94,9 | 0,780 | 94,9 | 0,800 | 94,8 | 0,820 | 94,9 |
| 0,840 | 94,8 | 0,860 | 95,0 | 0,880 | 95,0 | 0,900 | 95,2 | 0,920 | 95,1 |
| 0,940 | 94,8 | 0,960 | 95,2 | 0,980 | 95,2 | 1,000 | 94,9 | 1,020 | 95,0 |
| 1,040 | 94,8 | 1,060 | 95,2 | 1,080 | 95,0 | 1,100 | 95,2 | 1,120 | 95,0 |
| 1,140 | 95,0 | 1,160 | 95,1 | 1,180 | 94,9 | 1,200 | 95,2 | 1,220 | 95,2 |
| 1,240 | 95,1 | 1,260 | 95,3 | 1,280 | 95,2 | 1,300 | 95,2 | 1,320 | 95,1 |
| 1,340 | 94,7 | 1,360 | 94,1 | 1,380 | 93,9 | 1,400 | 94,6 | 1,420 | 94,8 |
| 1,440 | 94,9 | 1,460 | 94,9 | 1,480 | 95,0 | 1,500 | 95,1 | 1,520 | 94,9 |
| 1,540 | 94,8 | 1,560 | 94,9 | 1,580 | 94,9 | 1,600 | 94,7 | 1,620 | 94,8 |
| 1,640 | 94,8 | 1,660 | 94,7 | 1,680 | 94,6 | 1,700 | 94,3 | 1,720 | 94,0 |
| 1,740 | 94,2 | 1,760 | 94,1 | 1,780 | 93,6 | 1,800 | 93,6 | 1,820 | 93,4 |
| 1,840 | 93,4 | 1,860 | 93,5 | 1,880 | 93,2 | 1,900 | 93,2 | 1,920 | 92,8 |
| 1,940 | 92,9 | 1,960 | 92,6 | 1,980 | 92,3 | 2,000 | 92,1 | 2,020 | 91,4 |
| 2,040 | 90,7 | 2,060 | 90,0 | 2,080 | 89,1 | 2,100 | 88,4 | 2,120 | 88,0 |
| 2,140 | 87,2 | 2,160 | 86,6 | 2,180 | 85,9 | 2,200 | 85,4 | 2,220 | 84,9 |
| 2,240 | 85,0 | 2,260 | 85,4 | 2,280 | 85,4 | 2,300 | 85,4 | 2,320 | 85,4 |
| 2,340 | 84,8 | 2,360 | 84,2 | 2,380 | 83,4 | 2,400 | 82,7 | 2,420 | 81,[illegible] |
| 2,440 | 80,4 | 2,460 | 80,2 | 2,480 | 79,3 | 2,506 | 78,[illegible] | | |



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FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS K-7 23 AUG 78 100180002

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU IN SITU, AFTER 50 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.106

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 5.7 | 0.252 | 6.0 | 0.254 | 6.1 | 0.256 | 6.0 | 0.258 | 6.0 |
| 0.260 | 5.9 | 0.262 | 5.9 | 0.264 | 5.9 | 0.266 | 5.8 | 0.268 | 5.8 |
| 0.270 | 6.0 | 0.272 | 5.8 | 0.274 | 5.9 | 0.276 | 5.8 | 0.278 | 5.9 |
| 0.280 | 5.6 | 0.282 | 5.8 | 0.284 | 5.8 | 0.286 | 5.7 | 0.288 | 5.6 |
| 0.290 | 5.6 | 0.292 | 5.5 | 0.294 | 5.7 | 0.296 | 5.8 | 0.298 | 6.0 |
| 0.300 | 5.9 | 0.302 | 5.9 | 0.304 | 6.1 | 0.306 | 6.2 | 0.308 | 6.3 |
| 0.310 | 6.5 | 0.312 | 6.7 | 0.314 | 7.4 | 0.316 | 8.1 | 0.318 | 9.9 |
| 0.320 | 12.5 | 0.322 | 16.7 | 0.324 | 22.1 | 0.326 | 28.6 | 0.328 | 35.5 |
| 0.330 | 41.8 | 0.332 | 47.3 | 0.334 | 51.5 | 0.336 | 55.1 | 0.338 | 58.5 |
| 0.340 | 61.3 | 0.342 | 63.2 | 0.344 | 65.7 | 0.346 | 67.5 | 0.348 | 69.4 |
| 0.350 | 70.7 | 0.352 | 72.5 | 0.354 | 73.7 | 0.356 | 75.3 | 0.358 | 75.9 |
| 0.360 | 77.4 | 0.365 | 79.5 | 0.370 | 81.2 | 0.375 | 82.6 | 0.380 | 84.5 |
| 0.385 | 86.1 | 0.390 | 86.6 | 0.395 | 87.5 | 0.400 | 88.2 | 0.405 | 88.9 |
| 0.410 | 89.4 | 0.415 | 89.5 | 0.420 | 89.8 | 0.425 | 90.0 | 0.430 | 90.6 |
| 0.435 | 90.5 | 0.440 | 90.8 | 0.445 | 90.6 | 0.450 | 91.0 | 0.455 | 91.1 |
| 0.460 | 91.0 | 0.465 | 91.4 | 0.470 | 90.9 | 0.475 | 91.0 | 0.480 | 91.4 |
| 0.485 | 91.4 | 0.490 | 91.3 | 0.495 | 92.1 | 0.500 | 91.5 | 0.505 | 92.2 |
| 0.510 | 92.0 | 0.515 | 92.2 | 0.520 | 92.1 | 0.525 | 92.4 | 0.530 | 92.5 |
| 0.535 | 92.5 | 0.540 | 92.9 | 0.545 | 93.0 | 0.550 | 92.8 | 0.555 | 93.2 |
| 0.560 | 93.1 | 0.565 | 93.7 | 0.570 | 93.9 | 0.575 | 93.4 | 0.580 | 93.6 |
| 0.585 | 93.8 | 0.590 | 93.8 | 0.595 | 93.5 | 0.600 | 94.0 | 0.605 | 93.5 |
| 0.610 | 93.6 | 0.615 | 93.4 | 0.620 | 93.9 | 0.625 | 93.6 | 0.630 | 93.8 |
| 0.635 | 93.5 | 0.640 | 93.7 | 0.645 | 93.8 | 0.650 | 93.9 | 0.655 | 93.8 |
| 0.660 | 94.0 | 0.665 | 94.0 | 0.670 | 93.8 | 0.675 | [illegible] | 0.680 | 94.2 |
| 0.685 | 94.2 | 0.690 | 94.2 | 0.695 | 94.3 | 0.700 | [illegible] | 0.720 | 94.8 |
| 0.740 | 94.8 | 0.760 | 94.8 | 0.780 | 95.1 | 0.800 | 94.3 | 0.820 | 94.7 |
| 0.840 | 94.7 | 0.860 | 94.9 | 0.880 | 95.0 | 0.900 | 95.[illegible] | 0.920 | 95.3 |
| 0.940 | 94.9 | 0.960 | 95.2 | 0.980 | 95.2 | 1.000 | 95.[illegible] | 1.020 | 95.3 |
| 1.040 | 95.0 | 1.060 | 95.2 | 1.080 | 95.1 | 1.100 | 95.4 | 1.120 | 95.2 |
| 1.140 | 95.1 | 1.160 | 95.3 | 1.180 | 95.1 | 1.200 | 95.2 | 1.220 | 95.3 |
| 1.240 | 95.4 | 1.260 | 95.3 | 1.280 | 95.2 | 1.300 | 95.3 | 1.320 | 95.1 |
| 1.340 | 94.8 | 1.360 | 94.3 | 1.380 | 93.9 | 1.400 | 94.7 | 1.420 | 94.8 |
| 1.440 | 94.8 | 1.460 | 94.9 | 1.480 | 94.9 | 1.500 | 95.1 | 1.520 | 94.9 |
| 1.540 | 94.8 | 1.560 | 94.8 | 1.580 | 94.9 | 1.600 | 94.3 | 1.620 | 94.7 |
| 1.640 | 94.7 | 1.660 | 94.5 | 1.680 | 94.5 | 1.700 | 94.[illegible] | 1.720 | 94.[illegible] |
| 1.740 | 94.2 | 1.760 | 94.0 | 1.780 | 93.7 | 1.800 | 93.[illegible] | 1.820 | 93.3 |
| 1.840 | 93.2 | 1.860 | 93.3 | 1.880 | 93.0 | 1.900 | 93.1 | 1.920 | 92.[illegible] |
| 1.940 | 92.8 | 1.960 | 92.4 | 1.980 | 92.1 | 2.000 | 91.8 | 2.020 | [illegible].2 |
| 2.040 | 90.5 | 2.060 | 89.9 | 2.080 | 88.9 | 2.100 | 88.3 | 2.120 | 86.0 |
| 2.140 | 87.3 | 2.160 | 86.6 | 2.180 | 85.7 | 2.200 | 85.2 | 2.220 | [illegible].9 |
| 2.240 | 85.1 | 2.260 | 85.4 | 2.280 | 85.5 | 2.300 | 83.4 | 2.320 | 85.0 |
| 2.340 | 84.6 | 2.360 | 84.2 | 2.380 | 83.3 | 2.400 | 82.3 | 2.420 | [illegible].5 |
| 2.440 | 80.4 | 2.460 | 80.1 | 2.480 | 79.1 | 2.500 | 78.7 | | |

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, K-3 23 AUG 78 100180003

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU IN SITU, AFTER 154 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.109

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 6.4 | 0.252 | 6.4 | 0.254 | 6.4 | 0.256 | 6.5 | 0.258 | 6.4 |
| 0.260 | 6.4 | 0.262 | 6.4 | 0.264 | 6.4 | 0.266 | 6.5 | 0.268 | 6.4 |
| 0.270 | 6.3 | 0.272 | 6.3 | 0.274 | 6.2 | 0.276 | 6.3 | 0.278 | 6.2 |
| 0.280 | 6.3 | 0.282 | 6.3 | 0.284 | 6.2 | 0.286 | 6.2 | 0.288 | 6.2 |
| 0.290 | 6.1 | 0.292 | 6.2 | 0.294 | 6.3 | 0.296 | 6.3 | 0.298 | 6.5 |
| 0.300 | 6.6 | 0.302 | 6.6 | 0.304 | 6.6 | 0.306 | 6.7 | 0.308 | 6.8 |
| 0.310 | 7.1 | 0.312 | 7.5 | 0.314 | 7.9 | 0.316 | 8.7 | 0.318 | 10.6 |
| 0.320 | 13.1 | 0.322 | 17.1 | 0.324 | 22.0 | 0.326 | 28.6 | 0.328 | 34.8 |
| 0.330 | 40.5 | 0.332 | 45.7 | 0.334 | 49.5 | 0.336 | 53.2 | 0.338 | 56.8 |
| 0.340 | 59.1 | 0.342 | 61.3 | 0.344 | 63.1 | 0.346 | 64.7 | 0.348 | 66.7 |
| 0.350 | 68.3 | 0.352 | 69.5 | 0.354 | 71.0 | 0.356 | 72.2 | 0.358 | 73.8 |
| 0.360 | 74.8 | 0.365 | 77.0 | 0.370 | 78.8 | 0.375 | 80.7 | 0.380 | 82.4 |
| 0.385 | 83.8 | 0.390 | 84.9 | 0.395 | 86.4 | 0.400 | 86.7 | 0.405 | 87.0 |
| 0.410 | 87.6 | 0.415 | 88.0 | 0.420 | 88.4 | 0.425 | 88.3 | 0.430 | 89.1 |
| 0.435 | 88.8 | 0.440 | 89.2 | 0.445 | 89.2 | 0.450 | 89.7 | 0.455 | 90.1 |
| 0.460 | 90.1 | 0.465 | 90.1 | 0.470 | 90.4 | 0.475 | 90.2 | 0.480 | 90.7 |
| 0.485 | 90.5 | 0.490 | 90.7 | 0.495 | 91.1 | 0.500 | 91.2 | 0.505 | 91.6 |
| 0.510 | 91.2 | 0.515 | 91.6 | 0.520 | 91.5 | 0.525 | 91.6 | 0.530 | 92.2 |
| 0.535 | 92.0 | 0.540 | 92.5 | 0.545 | 92.6 | 0.550 | 92.5 | 0.555 | 92.5 |
| 0.560 | 92.9 | 0.565 | 93.5 | 0.570 | 93.3 | 0.575 | 93.2 | 0.580 | 92.9 |
| 0.585 | 93.8 | 0.590 | 93.6 | 0.595 | 93.1 | 0.600 | 93.7 | 0.605 | 93.4 |
| 0.610 | 93.7 | 0.615 | 93.3 | 0.620 | 93.5 | 0.625 | 93.9 | 0.630 | 93.8 |
| 0.635 | 93.6 | 0.640 | 94.0 | 0.645 | 93.5 | 0.650 | 93.7 | 0.655 | 93.6 |
| 0.660 | 93.8 | 0.665 | 94.0 | 0.670 | 94.2 | 0.675 | 94.3 | 0.680 | 94.0 |
| 0.685 | 94.1 | 0.690 | 94.1 | 0.695 | 94.4 | 0.700 | 94.3 | 0.720 | 94.5 |
| 0.740 | 94.7 | 0.760 | 94.8 | 0.780 | 94.9 | 0.800 | 94.8 | 0.820 | 94.8 |
| 0.840 | 94.8 | 0.860 | 95.2 | 0.880 | 95.2 | 0.900 | 95.2 | 0.920 | 95.2 |
| 0.940 | 94.9 | 0.960 | 95.3 | 0.980 | 95.2 | 1.000 | 95.0 | 1.020 | 95.3 |
| 1.040 | 95.0 | 1.060 | 95.2 | 1.080 | 95.2 | 1.100 | 95.4 | 1.120 | 95.2 |
| 1.140 | 95.0 | 1.160 | 95.3 | 1.180 | 95.2 | 1.200 | 95.4 | 1.220 | 95.3 |
| 1.240 | 95.3 | 1.260 | 95.5 | 1.280 | 95.4 | 1.300 | 95.4 | 1.320 | 95.2 |
| 1.340 | 94.7 | 1.360 | 94.3 | 1.380 | 94.1 | 1.400 | 94.7 | 1.420 | 94.9 |
| 1.440 | 94.9 | 1.460 | 95.0 | 1.480 | 94.9 | 1.500 | 95.1 | 1.520 | 95.0 |
| 1.540 | 94.9 | 1.560 | 94.9 | 1.580 | 94.9 | 1.600 | 94.8 | 1.620 | 94.8 |
| 1.640 | 94.9 | 1.660 | 94.8 | 1.680 | 94.5 | 1.700 | 94.4 | 1.720 | 94.3 |
| 1.740 | 94.3 | 1.760 | 94.0 | 1.780 | 93.8 | 1.800 | 93.7 | 1.820 | 93.5 |
| 1.840 | 93.3 | 1.860 | 93.3 | 1.880 | 93.1 | 1.900 | 93.2 | 1.920 | 92.9 |
| 1.940 | 92.7 | 1.960 | 92.5 | 1.980 | 92.3 | 2.000 | 91.8 | 2.020 | 91.3 |
| 2.040 | 90.8 | 2.060 | 90.2 | 2.080 | 89.1 | 2.100 | 88.5 | 2.120 | 88.0 |
| 2.140 | 87.4 | 2.160 | 86.7 | 2.180 | 85.9 | 2.200 | 85.4 | 2.220 | 84.9 |
| 2.240 | 85.0 | 2.260 | 85.4 | 2.280 | 85.4 | 2.300 | 85.4 | 2.320 | 85.1 |
| 2.340 | 84.7 | 2.360 | 84.1 | 2.380 | 83.4 | 2.400 | 82.5 | 2.420 | 81.6 |
| 2.440 | 80.6 | 2.460 | 80.1 | 2.480 | 79.3 | 2.500 | 76.7 | | |

FIGURE , EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, K-3 23 AUG 78 100140004

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU IN SITU, AFTER 313 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.114

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 6.4 | 0.252 | 6.7 | 0.254 | 6.7 | 0.256 | 6.5 | 0.258 | 6.6 |
| 0.260 | 6.5 | 0.262 | 6.6 | 0.264 | 6.6 | 0.266 | 6.4 | 0.268 | 6.5 |
| 0.270 | 6.4 | 0.272 | 6.4 | 0.274 | 6.4 | 0.276 | 6.5 | 0.278 | 6.5 |
| 0.280 | 6.5 | 0.282 | 6.3 | 0.284 | 6.2 | 0.286 | 6.2 | 0.288 | 6.2 |
| 0.290 | 6.3 | 0.292 | 6.1 | 0.294 | 6.2 | 0.296 | 6.2 | 0.298 | 6.3 |
| 0.300 | 6.9 | 0.302 | 6.9 | 0.304 | 8.6 | 0.306 | 6.6 | 0.308 | 6.9 |
| 0.310 | 7.1 | 0.312 | 7.2 | 0.314 | 7.7 | 0.316 | 8.8 | 0.318 | 10.2 |
| 0.320 | 12.5 | 0.322 | 16.4 | 0.324 | 21.3 | 0.326 | 27.4 | 0.328 | 35.0 |
| 0.330 | 38.8 | 0.332 | 43.9 | 0.334 | 47.6 | 0.336 | 51.3 | 0.338 | 53.7 |
| 0.340 | 56.5 | 0.342 | 58.6 | 0.344 | 60.6 | 0.346 | 62.5 | 0.348 | 63.5 |
| 0.350 | 65.4 | 0.352 | 68.6 | 0.354 | 67.9 | 0.356 | 69.1 | 0.358 | 70.5 |
| 0.360 | 71.8 | 0.365 | 74.2 | 0.370 | 75.8 | 0.375 | 77.6 | 0.380 | 79.4 |
| 0.385 | 81.3 | 0.390 | 82.7 | 0.395 | 83.8 | 0.400 | 84.2 | 0.405 | 84.6 |
| 0.410 | 85.6 | 0.415 | 85.9 | 0.420 | 86.8 | 0.425 | 87.0 | 0.430 | 87.2 |
| 0.435 | 87.8 | 0.440 | 87.8 | 0.445 | 87.7 | 0.450 | 88.4 | 0.455 | 88.6 |
| 0.460 | 88.7 | 0.465 | 88.9 | 0.470 | 89.0 | 0.475 | 88.6 | 0.480 | 89.4 |
| 0.485 | 89.0 | 0.490 | 89.3 | 0.495 | 89.7 | 0.500 | 89.8 | 0.505 | 90.3 |
| 0.510 | 90.2 | 0.515 | 90.5 | 0.520 | 90.6 | 0.525 | 91.0 | 0.530 | 91.2 |
| 0.535 | 91.1 | 0.540 | 91.8 | 0.545 | 92.0 | 0.550 | 91.9 | 0.555 | 91.9 |
| 0.560 | 91.9 | 0.565 | 92.1 | 0.570 | 92.7 | 0.575 | 92.9 | 0.580 | 92.8 |
| 0.585 | 93.2 | 0.590 | 93.0 | 0.595 | 92.7 | 0.600 | 93.2 | 0.605 | 93.1 |
| 0.610 | 93.1 | 0.615 | 93.1 | 0.620 | 93.1 | 0.625 | 93.4 | 0.630 | 93.5 |
| 0.635 | 93.3 | 0.640 | 93.9 | 0.645 | 93.2 | 0.650 | 93.4 | 0.655 | 93.8 |
| 0.660 | 93.7 | 0.665 | 93.9 | 0.670 | 93.8 | 0.675 | 93.7 | 0.680 | 93.7 |
| 0.685 | 93.8 | 0.690 | 93.7 | 0.695 | 93.9 | 0.700 | 94.2 | 0.720 | 94.7 |
| 0.740 | 94.4 | 0.760 | 94.8 | 0.780 | 95.0 | 0.800 | 94.9 | 0.820 | 94.7 |
| 0.840 | 94.7 | 0.860 | 95.1 | 0.880 | 95.2 | 0.900 | 95.2 | 0.920 | 95.0 |
| 0.940 | 94.9 | 0.960 | 95.2 | 0.980 | 95.4 | 1.000 | 95.1 | 1.020 | 95.3 |
| 1.040 | 94.8 | 1.060 | 95.3 | 1.080 | 95.3 | 1.100 | 95.6 | 1.120 | 95.5 |
| 1.140 | 95.3 | 1.160 | 95.4 | 1.180 | 95.5 | 1.200 | 95.4 | 1.220 | 95.6 |
| 1.240 | 95.3 | 1.260 | 95.5 | 1.280 | 95.4 | 1.300 | 95.5 | 1.320 | 95.5 |
| 1.340 | 94.8 | 1.360 | 94.5 | 1.380 | 94.2 | 1.400 | 95.0 | 1.420 | 95.1 |
| 1.440 | 95.2 | 1.460 | 95.2 | 1.480 | 95.3 | 1.500 | 95.4 | 1.520 | 95.5 |
| 1.540 | 95.0 | 1.560 | 95.0 | 1.580 | 95.0 | 1.600 | 94.9 | 1.620 | 95.0 |
| 1.640 | 95.0 | 1.660 | 94.8 | 1.680 | 94.7 | 1.700 | 94.8 | 1.720 | 94.3 |
| 1.740 | 94.3 | 1.760 | 94.2 | 1.780 | 93.9 | 1.800 | 93.9 | 1.820 | 93.8 |
| 1.840 | 93.5 | 1.860 | 93.6 | 1.880 | 93.4 | 1.900 | 93.5 | 1.920 | 93.0 |
| 1.940 | 93.0 | 1.960 | 92.7 | 1.980 | 92.5 | 2.000 | 92.3 | 2.020 | 91.9 |
| 2.040 | 90.9 | 2.060 | 90.1 | 2.080 | 89.2 | 2.100 | 88.5 | 2.120 | 88.2 |
| 2.140 | 87.4 | 2.160 | 86.9 | 2.180 | 86.2 | 2.200 | 89.6 | 2.220 | 85.2 |
| 2.210 | 85.9 | 2.260 | 85.8 | 2.280 | 89.8 | 2.300 | 85.5 | 2.320 | 85.3 |
| 2.340 | 84.7 | 2.360 | 83.3 | 2.380 | 83.4 | 2.400 | 82.7 | 2.420 | 81.6 |
| 2.440 | 80.7 | 2.460 | 80.2 | 2.480 | 79.5 | 2.500 | 78.9 | | |

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FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, K-3 23 AUG 78 100140005

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU IN SITU, AFTER 503 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.118

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 6.9 | 0.252 | 6.9 | 0.254 | 7.0 | 0.256 | 7.0 | 0.258 | 6.9 |
| 0.260 | 6.8 | 0.262 | 6.9 | 0.264 | 6.8 | 0.266 | 6.7 | 0.268 | 6.8 |
| 0.270 | 6.7 | 0.272 | 6.7 | 0.274 | 6.7 | 0.276 | 6.7 | 0.278 | 6.6 |
| 0.280 | 6.7 | 0.282 | 6.5 | 0.284 | 6.6 | 0.286 | 6.6 | 0.288 | 6.6 |
| 0.290 | 6.4 | 0.292 | 6.5 | 0.294 | 6.5 | 0.296 | 6.6 | 0.298 | 6.7 |
| 0.300 | 6.8 | 0.302 | 6.8 | 0.304 | 7.1 | 0.306 | 6.9 | 0.308 | 7.1 |
| 0.310 | 7.2 | 0.312 | 7.6 | 0.314 | 8.0 | 0.316 | 8.9 | 0.318 | 10.4 |
| 0.320 | 12.7 | 0.322 | 16.3 | 0.324 | 21.0 | 0.326 | 27.0 | 0.328 | 32.5 |
| 0.330 | 37.8 | 0.332 | 42.6 | 0.334 | 46.0 | 0.336 | 49.2 | 0.338 | 52.0 |
| 0.340 | 54.4 | 0.342 | 56.7 | 0.344 | 59.0 | 0.346 | 60.0 | 0.348 | 61.9 |
| 0.350 | 63.5 | 0.352 | 65.1 | 0.354 | 66.1 | 0.356 | 67.3 | 0.358 | 68.3 |
| 0.360 | 70.2 | 0.365 | 72.4 | 0.370 | 74.5 | 0.375 | 75.9 | 0.380 | 78.1 |
| 0.385 | 79.7 | 0.390 | 81.0 | 0.395 | 82.1 | 0.400 | 82.8 | 0.405 | 83.6 |
| 0.410 | 84.4 | 0.415 | 84.6 | 0.420 | 85.2 | 0.425 | 85.3 | 0.430 | 86.2 |
| 0.435 | 86.1 | 0.440 | 86.6 | 0.445 | 86.8 | 0.450 | 87.5 | 0.455 | 87.5 |
| 0.460 | 88.0 | 0.465 | 87.7 | 0.470 | 88.0 | 0.475 | 87.9 | 0.480 | 88.8 |
| 0.485 | 88.7 | 0.490 | 88.5 | 0.495 | 89.1 | 0.500 | 88.8 | 0.505 | 89.7 |
| 0.510 | 89.9 | 0.515 | 89.8 | 0.520 | 89.9 | 0.525 | 90.5 | 0.530 | 90.8 |
| 0.535 | 90.4 | 0.540 | 91.4 | 0.545 | 91.6 | 0.550 | 91.5 | 0.555 | 91.5 |
| 0.560 | 91.8 | 0.565 | 92.2 | 0.570 | 92.2 | 0.575 | 92.6 | 0.580 | 92.4 |
| 0.585 | 93.1 | 0.590 | 93.4 | 0.595 | 92.6 | 0.600 | 93.1 | 0.605 | 92.7 |
| 0.610 | 93.0 | 0.615 | 92.7 | 0.620 | 92.9 | 0.625 | 93.0 | 0.630 | 92.8 |
| 0.635 | 93.5 | 0.640 | 93.3 | 0.645 | 93.2 | 0.650 | 93.3 | 0.655 | 93.6 |
| 0.660 | 93.7 | 0.665 | 93.3 | 0.670 | 93.1 | 0.675 | 94.2 | 0.680 | 93.7 |
| 0.685 | 93.7 | 0.690 | 93.7 | 0.695 | 93.8 | 0.700 | 93.9 | 0.720 | 94.2 |
| 0.740 | 94.4 | 0.760 | 94.5 | 0.780 | 94.7 | 0.800 | 94.6 | 0.820 | 94.7 |
| 0.840 | 94.7 | 0.860 | 95.0 | 0.880 | 95.0 | 0.900 | 95.2 | 0.920 | 94.9 |
| 0.940 | 94.8 | 0.960 | 95.3 | 0.980 | 95.2 | 1.000 | 95.1 | 1.020 | 95.2 |
| 1.040 | 95.0 | 1.060 | 95.2 | 1.080 | 95.1 | 1.100 | 95.3 | 1.120 | 95.2 |
| 1.140 | 95.1 | 1.160 | 95.2 | 1.180 | 95.2 | 1.200 | 95.3 | 1.220 | 95.4 |
| 1.240 | 95.4 | 1.260 | 95.4 | 1.280 | 95.3 | 1.300 | 95.3 | 1.320 | 95.0 |
| 1.340 | 94.7 | 1.360 | 94.1 | 1.380 | 94.0 | 1.400 | 94.5 | 1.420 | 94.8 |
| 1.440 | 94.8 | 1.460 | 94.9 | 1.480 | 94.9 | 1.500 | 95.0 | 1.520 | 94.9 |
| 1.540 | 94.9 | 1.560 | 94.9 | 1.580 | 94.9 | 1.600 | 94.7 | 1.620 | 94.8 |
| 1.640 | 94.6 | 1.660 | 94.4 | 1.680 | 94.4 | 1.700 | 94.1 | 1.720 | 94.1 |
| 1.740 | 94.2 | 1.760 | 93.9 | 1.780 | 93.7 | 1.800 | 93.5 | 1.820 | 93.0 |
| 1.840 | 93.2 | 1.860 | 93.2 | 1.880 | 93.0 | 1.900 | 93.0 | 1.920 | 92.5 |
| 1.940 | 92.7 | 1.960 | 92.3 | 1.980 | 92.1 | 2.000 | 91.7 | 2.020 | 91.4 |
| 2.040 | 90.6 | 2.060 | 89.9 | 2.080 | 89.0 | 2.100 | 88.3 | 2.120 | 87.8 |
| 2.140 | 87.1 | 2.160 | 86.5 | 2.180 | 85.7 | 2.200 | 85.2 | 2.220 | 84.8 |
| 2.240 | 84.9 | 2.260 | 85.1 | 2.280 | 85.1 | 2.300 | 85.2 | 2.320 | 85.0 |
| 2.340 | 84.5 | 2.360 | 84.0 | 2.380 | 83.1 | 2.400 | 82.2 | 2.420 | 81.4 |
| 2.440 | 80.3 | 2.460 | 79.9 | 2.480 | 79.2 | 2.500 | 78.5 | | |

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, K-2 23 AUG 78 100240001

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU IN VACUUM, BEFORE EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.098

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 6.1 | 0.252 | 6.8 | 0.254 | 6.0 | 0.256 | 6.1 | 0.258 | 6.2 |
| 0.260 | 6.7 | 0.262 | 6.2 | 0.264 | 6.5 | 0.266 | 6.1 | 0.268 | 6.1 |
| 0.270 | 6.3 | 0.272 | 5.9 | 0.274 | 6.3 | 0.276 | 6.5 | 0.278 | 6.2 |
| 0.280 | 5.9 | 0.282 | 5.7 | 0.284 | 6.1 | 0.286 | 6.0 | 0.288 | 6.1 |
| 0.290 | 6.1 | 0.292 | 6.4 | 0.294 | 6.5 | 0.296 | 7.0 | 0.298 | 6.8 |
| 0.300 | 6.5 | 0.302 | 6.6 | 0.304 | 6.6 | 0.306 | 7.2 | 0.308 | 7.7 |
| 0.310 | 6.8 | 0.312 | 7.4 | 0.314 | 8.1 | 0.316 | 9.1 | 0.318 | 11.1 |
| 0.320 | 14.1 | 0.322 | 18.8 | 0.324 | 24.4 | 0.326 | 31.9 | 0.328 | 39.1 |
| 0.330 | 40.3 | 0.332 | 52.0 | 0.334 | 56.4 | 0.336 | 60.2 | 0.338 | 64.1 |
| 0.340 | 66.7 | 0.342 | 69.3 | 0.344 | 71.4 | 0.346 | 73.6 | 0.348 | 75.0 |
| 0.350 | 76.6 | 0.352 | 77.7 | 0.354 | 78.9 | 0.356 | 80.2 | 0.358 | 81.8 |
| 0.360 | 82.3 | 0.365 | 84.3 | 0.370 | 85.5 | 0.375 | 86.5 | 0.380 | 88.0 |
| 0.385 | 89.5 | 0.39 | 90.4 | 0.395 | 90.9 | 0.400 | 91.3 | 0.405 | 91.5 |
| 0.410 | 92.1 | 0.415 | 92.3 | 0.420 | 92.6 | 0.425 | 92.5 | 0.430 | 92.9 |
| 0.435 | 92.9 | 0.440 | 93.1 | 0.445 | 92.5 | 0.450 | 93.2 | 0.455 | 93.2 |
| 0.460 | 93.3 | 0.465 | 93.0 | 0.470 | 93.0 | 0.475 | 92.9 | 0.480 | 93.2 |
| 0.485 | 93.1 | 0.490 | 93.2 | 0.495 | 93.3 | 0.500 | 93.3 | 0.505 | 93.8 |
| 0.510 | 93.0 | 0.515 | 93.4 | 0.520 | 93.3 | 0.525 | 93.6 | 0.530 | 93.6 |
| 0.535 | 93.7 | 0.540 | 93.9 | 0.545 | 93.9 | 0.550 | 93.7 | 0.555 | 94.1 |
| 0.560 | 94.0 | 0.565 | 94.3 | 0.570 | 93.9 | 0.575 | 94.0 | 0.580 | 94.1 |
| 0.585 | 94.4 | 0.590 | 94.2 | 0.595 | 93.8 | 0.600 | 94.2 | 0.605 | 93.9 |
| 0.610 | 93.9 | 0.615 | 94.0 | 0.620 | 93.8 | 0.625 | 94.1 | 0.630 | 94.0 |
| 0.635 | 94.0 | 0.640 | 94.0 | 0.645 | 94.4 | 0.650 | 94.3 | 0.655 | 94.0 |
| 0.660 | 94.2 | 0.665 | 94.3 | 0.670 | 94.4 | 0.675 | 94.5 | 0.680 | 94.4 |
| 0.685 | 94.3 | 0.690 | 94.3 | 0.695 | 94.4 | 0.700 | 94.3 | 0.720 | 94.9 |
| 0.740 | 95.0 | 0.760 | 94.9 | 0.780 | 94.7 | 0.800 | 94.8 | 0.820 | 94.8 |
| 0.840 | 94.7 | 0.860 | 95.0 | 0.880 | 94.8 | 0.900 | 95.0 | 0.920 | 94.9 |
| 0.940 | 94.8 | 0.960 | 95.0 | 0.980 | 95.1 | 1.000 | 94.8 | 1.020 | 95.0 |
| 1.040 | 94.7 | 1.060 | 95.0 | 1.080 | 94.7 | 1.100 | 94.9 | 1.120 | 94.9 |
| 1.140 | 94.9 | 1.160 | 95.0 | 1.180 | 94.8 | 1.200 | 95.0 | 1.220 | 95.1 |
| 1.240 | 95.1 | 1.260 | 95.3 | 1.280 | 95.1 | 1.300 | 95.1 | 1.320 | 95.0 |
| 1.340 | 94.5 | 1.360 | 94.1 | 1.380 | 93.8 | 1.400 | 94.6 | 1.420 | 94.8 |
| 1.440 | 94.8 | 1.460 | 94.8 | 1.480 | 94.9 | 1.500 | 95.1 | 1.520 | 94.9 |
| 1.540 | 94.8 | 1.560 | 94.9 | 1.580 | 94.9 | 1.600 | 94.8 | 1.620 | 94.9 |
| 1.640 | 94.9 | 1.660 | 94.7 | 1.680 | 94.7 | 1.700 | 94.4 | 1.720 | 94.2 |
| 1.740 | 94.3 | 1.760 | 94.1 | 1.780 | 93.9 | 1.800 | 93.8 | 1.820 | 93.6 |
| 1.840 | 93.5 | 1.860 | 93.5 | 1.880 | 93.5 | 1.900 | 93.4 | 1.920 | 93.0 |
| 1.940 | 93.1 | 1.960 | 92.8 | 1.980 | 92.5 | 2.000 | 92.3 | 2.020 | 91.7 |
| 2.040 | 90.9 | 2.060 | 90.3 | 2.080 | 89.2 | 2.100 | 88.6 | 2.120 | 86.2 |
| 2.140 | 87.5 | 2.160 | 86.9 | 2.180 | 86.1 | 2.200 | 85.6 | 2.220 | 85.2 |
| 2.240 | 85.2 | 2.260 | 85.7 | 2.280 | 85.8 | 2.300 | 85.7 | 2.320 | 85.4 |
| 2.340 | 84.9 | 2.360 | 84.5 | 2.380 | 83.6 | 2.400 | 82.9 | 2.420 | 81.9 |
| 2.440 | 80.8 | 2.460 | 80.5 | 2.480 | 79.7 | 2.500 | 79.2 | | |

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, K-2 23 AUG 78 100240002

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU IN SITU, AFTER 50 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.109

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 6.2 | 0.252 | 6.1 | 0.254 | 6.1 | 0.256 | 6.0 | 0.258 | 6.0 |
| 0.260 | 5.9 | 0.262 | 5.9 | 0.264 | 6.0 | 0.266 | 5.9 | 0.268 | 6.0 |
| 0.270 | 5.9 | 0.272 | 5.8 | 0.274 | 5.9 | 0.276 | 5.8 | 0.278 | 5.7 |
| 0.280 | 5.9 | 0.282 | 5.7 | 0.284 | 5.7 | 0.286 | 5.7 | 0.288 | 5.9 |
| 0.290 | 5.9 | 0.292 | 5.9 | 0.294 | 5.6 | 0.296 | 5.8 | 0.298 | 5.9 |
| 0.300 | 6.1 | 0.302 | 6.0 | 0.304 | 6.1 | 0.306 | 6.2 | 0.308 | 6.4 |
| 0.310 | 6.5 | 0.312 | 6.9 | 0.314 | 7.5 | 0.316 | 8.4 | 0.318 | 10.2 |
| 0.320 | 12.7 | 0.322 | 16.8 | 0.324 | 21.9 | 0.326 | 28.7 | 0.328 | 35.2 |
| 0.330 | 41.3 | 0.332 | 47.1 | 0.334 | 51.2 | 0.336 | 55.0 | 0.338 | 58.0 |
| 0.340 | 60.9 | 0.342 | 62.9 | 0.344 | 65.3 | 0.346 | 66.8 | 0.348 | 68.5 |
| 0.350 | 70.2 | 0.352 | 71.8 | 0.354 | 72.9 | 0.356 | 74.3 | 0.358 | 75.3 |
| 0.360 | 76.3 | 0.365 | 78.3 | 0.370 | 79.8 | 0.375 | 81.1 | 0.380 | 82.9 |
| 0.385 | 84.4 | 0.390 | 85.7 | 0.395 | 86.1 | 0.400 | 86.9 | 0.405 | 87.3 |
| 0.410 | 87.9 | 0.415 | 88.1 | 0.420 | 88.6 | 0.425 | 88.9 | 0.430 | 89.3 |
| 0.435 | 89.4 | 0.440 | 89.6 | 0.445 | 89.5 | 0.450 | 89.7 | 0.455 | 90.0 |
| 0.460 | 89.9 | 0.465 | 90.2 | 0.470 | 89.7 | 0.475 | 89.6 | 0.480 | 90.6 |
| 0.485 | 90.4 | 0.490 | 90.4 | 0.495 | 90.9 | 0.500 | 90.8 | 0.505 | 91.4 |
| 0.510 | 90.9 | 0.515 | 91.3 | 0.520 | 91.1 | 0.525 | 91.5 | 0.530 | 91.6 |
| 0.535 | 91.8 | 0.540 | 92.0 | 0.545 | 92.0 | 0.550 | 92.2 | 0.555 | 92.4 |
| 0.560 | 92.3 | 0.565 | 92.9 | 0.570 | 93.0 | 0.575 | 92.6 | 0.580 | 92.8 |
| 0.585 | 93.1 | 0.590 | 93.0 | 0.595 | 92.7 | 0.600 | 93.1 | 0.605 | 92.7 |
| 0.610 | 93.0 | 0.615 | 92.8 | 0.620 | 93.1 | 0.625 | 92.9 | 0.630 | 92.9 |
| 0.635 | 92.9 | 0.640 | 93.0 | 0.645 | 93.0 | 0.650 | 93.4 | 0.655 | 93.3 |
| 0.660 | 93.4 | 0.665 | 93.5 | 0.670 | 93.6 | 0.675 | 94.0 | 0.680 | 93.8 |
| 0.685 | 94.0 | 0.690 | 93.9 | 0.695 | 94.0 | 0.700 | 94.2 | 0.720 | 95.1 |
| 0.740 | 95.1 | 0.760 | 95.0 | 0.780 | 95.3 | 0.800 | 94.9 | 0.820 | 94.9 |
| 0.840 | 94.8 | 0.860 | 94.8 | 0.880 | 95.0 | 0.900 | 95.2 | 0.920 | 95.2 |
| 0.940 | 95.0 | 0.960 | 95.2 | 0.980 | 95.1 | 1.000 | 95.0 | 1.020 | 95.3 |
| 1.040 | 95.1 | 1.060 | 95.2 | 1.080 | 95.2 | 1.100 | 95.4 | 1.120 | 95.1 |
| 1.140 | 95.0 | 1.160 | 95.1 | 1.180 | 95.2 | 1.200 | 95.3 | 1.220 | 95.4 |
| 1.240 | 95.4 | 1.260 | 95.3 | 1.280 | 95.2 | 1.300 | 95.4 | 1.320 | 95.1 |
| 1.340 | 94.8 | 1.360 | 94.2 | 1.380 | 93.9 | 1.400 | 94.6 | 1.420 | 94.9 |
| 1.440 | 94.8 | 1.460 | 94.9 | 1.480 | 95.1 | 1.500 | 95.1 | 1.520 | 95.0 |
| 1.540 | 94.9 | 1.560 | 94.9 | 1.580 | 95.0 | 1.600 | 94.9 | 1.620 | 94.9 |
| 1.640 | 94.8 | 1.660 | 94.7 | 1.680 | 94.7 | 1.700 | 94.4 | 1.720 | 94.2 |
| 1.740 | 94.5 | 1.760 | 94.2 | 1.780 | 93.8 | 1.800 | 93.8 | 1.820 | 93.7 |
| 1.840 | 93.4 | 1.860 | 93.5 | 1.880 | 93.3 | 1.900 | 93.4 | 1.920 | 93.0 |
| 1.940 | 93.0 | 1.960 | 92.7 | 1.980 | 92.3 | 2.000 | 92.2 | 2.020 | 91.4 |
| 2.040 | 90.7 | 2.060 | 90.3 | 2.080 | 89.2 | 2.100 | 88.6 | 2.120 | 88.3 |
| 2.140 | 87.5 | 2.160 | 86.9 | 2.180 | 86.1 | 2.200 | 85.5 | 2.220 | 85.1 |
| 2.240 | 85.3 | 2.260 | 85.7 | 2.280 | 85.7 | 2.300 | 85.6 | 2.320 | 85.5 |
| 2.340 | 84.8 | 2.360 | 84.4 | 2.380 | 83.5 | 2.400 | 82.6 | 2.420 | 81.7 |
| 2.440 | 80.9 | 2.460 | 80.4 | 2.480 | 79.5 | 2.500 | 79.0 | | |

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, K-2 23 AUG 78 10024000З

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU IN SITU, AFTER 154 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.111

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 6.5 | 0.252 | 6.5 | 0.254 | 6.4 | 0.256 | 6.5 | 0.258 | 6.4 |
| 0.260 | 6.5 | 0.262 | 6.3 | 0.264 | 6.4 | 0.266 | 6.4 | 0.268 | 6.3 |
| 0.270 | 6.2 | 0.272 | 6.2 | 0.274 | 6.1 | 0.276 | 6.2 | 0.278 | 6.1 |
| 0.280 | 6.2 | 0.282 | 6.1 | 0.284 | 6.0 | 0.286 | 6.0 | 0.288 | 6.1 |
| 0.290 | 6.1 | 0.292 | 6.1 | 0.294 | 6.2 | 0.296 | 6.2 | 0.298 | 6.2 |
| 0.300 | 6.5 | 0.302 | 6.5 | 0.304 | 6.6 | 0.306 | 6.7 | 0.308 | 6.7 |
| 0.310 | 7.0 | 0.312 | 7.5 | 0.314 | 7.7 | 0.316 | 8.9 | 0.318 | 10.6 |
| 0.320 | 13.3 | 0.322 | 16.9 | 0.324 | 22.2 | 0.326 | 28.4 | 0.328 | 34.8 |
| 0.330 | 40.5 | 0.332 | 45.2 | 0.334 | 49.4 | 0.336 | 52.5 | 0.338 | 55.5 |
| 0.340 | 57.9 | 0.342 | 60.4 | 0.344 | 62.3 | 0.346 | 64.1 | 0.348 | 66.2 |
| 0.350 | 67.3 | 0.352 | 68.7 | 0.354 | 70.4 | 0.356 | 71.1 | 0.358 | 72.7 |
| 0.360 | 74.0 | 0.365 | 76.1 | 0.370 | 78.2 | 0.375 | 79.8 | 0.380 | 81.8 |
| 0.385 | 83.0 | 0.390 | 84.4 | 0.395 | 85.4 | 0.400 | 86.1 | 0.405 | 86.6 |
| 0.410 | 87.3 | 0.415 | 87.5 | 0.420 | 88.0 | 0.425 | 88.0 | 0.430 | 88.2 |
| 0.435 | 88.4 | 0.440 | 88.9 | 0.445 | 88.8 | 0.450 | 89.2 | 0.455 | 89.8 |
| 0.460 | 90.1 | 0.465 | 89.7 | 0.470 | 90.0 | 0.475 | 89.8 | 0.480 | 90.4 |
| 0.485 | 90.2 | 0.490 | 90.5 | 0.495 | 90.9 | 0.500 | 90.8 | 0.505 | 91.2 |
| 0.510 | 90.8 | 0.515 | 91.3 | 0.520 | 91.2 | 0.525 | 91.5 | 0.530 | 92.0 |
| 0.535 | 91.5 | 0.540 | 91.9 | 0.545 | 92.2 | 0.550 | 92.2 | 0.555 | 92.4 |
| 0.560 | 92.3 | 0.565 | 92.8 | 0.570 | 92.7 | 0.575 | 92.6 | 0.580 | 92.8 |
| 0.585 | 93.3 | 0.590 | 93.3 | 0.595 | 92.[illegible] | 0.600 | 93.3 | 0.605 | 92.9 |
| 0.610 | 93.5 | 0.615 | 93.1 | 0.620 | 93.2 | 0.625 | 93.5 | 0.630 | 93.3 |
| 0.635 | 93.4 | 0.6[illegible] | 93.7 | 0.645 | 93.3 | 0.650 | 93.6 | 0.655 | 93.4 |
| 0.660 | 93.5 | 0.665 | 93.6 | 0.670 | 93.8 | 0.675 | 94.0 | 0.680 | 94.1 |
| 0.685 | 93.9 | 0.690 | 93.9 | 0.695 | 94.0 | 0.700 | 94.1 | 0.720 | 94.4 |
| 0.740 | 94.5 | 0.760 | 94.5 | 0.780 | 94.7 | 0.800 | 94.7 | 0.820 | 94.7 |
| 0.840 | 94.7 | 0.860 | 94.9 | 0.880 | 95.1 | 0.900 | 95.0 | 0.920 | 95.1 |
| 0.940 | 94.7 | 0.960 | 95.0 | 0.980 | 95.1 | 1.000 | 94.9 | 1.020 | 95.2 |
| 1.040 | 94.9 | 1.060 | 95.2 | 1.080 | 95.1 | 1.100 | 95.3 | 1.120 | 95.1 |
| 1.140 | 95.0 | 1.160 | 95.2 | 1.180 | 95.1 | 1.200 | 95.3 | 1.220 | 95.4 |
| 1.240 | 95.2 | 1.260 | 95.4 | 1.280 | 95.4 | 1.300 | 95.6 | 1.320 | 95.[illegible] |
| 1.340 | 94.8 | 1.360 | 94.3 | 1.380 | 94.2 | 1.400 | 94.8 | 1.420 | 95.0 |
| 1.440 | 95.0 | 1.460 | 95.1 | 1.480 | 95.1 | 1.500 | 95.2 | 1.520 | 95.2 |
| 1.540 | 95.1 | 1.560 | 95.1 | 1.580 | 95.2 | 1.600 | 95.0 | 1.620 | 95.0 |
| 1.640 | 95.0 | 1.660 | 95.0 | 1.680 | 94.8 | 1.700 | 94.5 | 1.720 | 94.5 |
| 1.740 | 94.6 | 1.760 | 94.4 | 1.780 | 94.2 | 1.800 | 94.1 | 1.820 | 94.0 |
| 1.840 | 93.7 | 1.860 | 93.8 | 1.880 | 93.5 | 1.900 | 93.5 | 1.920 | 93.2 |
| 1.940 | 93.2 | 1.960 | 92.9 | 1.980 | 92.7 | 2.000 | 92.3 | 2.020 | 91.8 |
| 2.040 | 91.2 | 2.060 | 90.5 | 2.080 | 89.4 | 2.100 | 86.9 | 2.[illegible]0 | 88.5 |
| 2.140 | 87.9 | 2.160 | 87.1 | 2.180 | 86.4 | 2.200 | 85.8 | 2.220 | 85.5 |
| 2.240 | 85.5 | 2.260 | 85.9 | 2.280 | 85.8 | 2.300 | 85.8 | 2.320 | 85.5 |
| 2.340 | 85.0 | 2.360 | 84.4 | 2.380 | 83.7 | 2.400 | 82.8 | 2.420 | 82.0 |
| 2.440 | 81.0 | 2.460 | 80.5 | 2.480 | 79.7 | 2.500 | 79.3 | | |

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, K-2 23 AUG 78 100240008

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU IN SITU, AFTER 313 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.117

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | [illegible] | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | [illegible] | 0.252 | 6.5 | 0.254 | 5.6 | 0.256 | 6.6 | 0.258 | 6.6 |
| 0.260 | 6.6 | 0.262 | 6.5 | 0.264 | 6.7 | 0.266 | 6.4 | 0.268 | 6.4 |
| 0.270 | 6.4 | 0.272 | 6.7 | 0.274 | 6.3 | 0.276 | 6.4 | 0.278 | 6.4 |
| 0.280 | 6.2 | 0.282 | 6.1 | 0.284 | 6.3 | 0.286 | 6.4 | 0.288 | 6.2 |
| 0.290 | 6.1 | 0.292 | 6.1 | 0.294 | 6.0 | 0.296 | 6.2 | 0.298 | 6.4 |
| 0.300 | 6.3 | 0.302 | 6.5 | 0.304 | 6.5 | 0.306 | 6.6 | 0.308 | 6.9 |
| 0.310 | 6.8 | 0.312 | 7.3 | 0.314 | 7.7 | 0.316 | 8.6 | 0.318 | 10.4 |
| 0.320 | 12.6 | 0.322 | 16.5 | 0.324 | 21.4 | 0.326 | 26.7 | 0.328 | 33.0 |
| 0.330 | 39.1 | 0.332 | 43.4 | 0.334 | 47.3 | 0.336 | 51.0 | 0.338 | 52.8 |
| 0.340 | 56.1 | 0.342 | 57.7 | 0.344 | 60.1 | 0.346 | 61.6 | 0.348 | 63.9 |
| 0.350 | 64.8 | 0.352 | 66.2 | 0.354 | 67.8 | 0.356 | 68.7 | 0.358 | 69.9 |
| 0.360 | 71.0 | 0.365 | 73.2 | 0.370 | 75.2 | 0.375 | 76.6 | 0.380 | 78.9 |
| 0.385 | 80.5 | 0.390 | 81.8 | 0.395 | 82.9 | 0.400 | 83.6 | 0.405 | 84.4 |
| 0.410 | 85.2 | 0.415 | 85.3 | 0.420 | 86.0 | 0.425 | 86.4 | 0.430 | 86.7 |
| 0.435 | 87.1 | 0.440 | 87.3 | 0.445 | 86.9 | 0.450 | 87.7 | 0.455 | 87.9 |
| 0.460 | 89.3 | 0.465 | 88.5 | 0.470 | 88.6 | 0.475 | 88.3 | 0.480 | 88.8 |
| 0.485 | 88.8 | 0.490 | 88.8 | 0.495 | 89.3 | 0.500 | 89.5 | 0.505 | 90.0 |
| 0.510 | 89.6 | 0.515 | 90.3 | 0.520 | 90.2 | 0.525 | 90.3 | 0.530 | 90.9 |
| 0.535 | 90.9 | 0.540 | 91.3 | 0.545 | 91.4 | 0.550 | 91.4 | 0.555 | 91.6 |
| 0.560 | 91.4 | 0.565 | 91.8 | 0.570 | 92.1 | 0.575 | 92.2 | 0.580 | 91.9 |
| 0.585 | 92.9 | 0.590 | 92.8 | 0.595 | 92.5 | 0.600 | 92.7 | 0.605 | 92.9 |
| 0.610 | 92.7 | 0.615 | 92.5 | 0.620 | 92.8 | 0.625 | 93.1 | 0.630 | 92.9 |
| 0.635 | 93.0 | 0.640 | 93.1 | 0.645 | 92.9 | 0.650 | 93.1 | 0.655 | 92.9 |
| 0.660 | 93.5 | 0.665 | 93.4 | 0.670 | 93.3 | 0.675 | 93.6 | 0.680 | 93.6 |
| 0.685 | 93.5 | 0.690 | 93.5 | 0.695 | 93.8 | 0.700 | 93.8 | 0.720 | 94.6 |
| 0.740 | 94.8 | 0.760 | 94.6 | 0.780 | 94.9 | 0.800 | 94.6 | 0.820 | 94.5 |
| 0.840 | 94.6 | 0.860 | 94.8 | 0.880 | 94.5 | 0.900 | 95.0 | 0.920 | 94.9 |
| 0.940 | 94.6 | 0.960 | 94.9 | 0.980 | 94.8 | 1.000 | 94.5 | 1.020 | 95.0 |
| 1.040 | 94.6 | 1.060 | 94.9 | 1.080 | 94.9 | 1.100 | 95.1 | 1.120 | 95.0 |
| 1.140 | 94.9 | 1.160 | 95.0 | 1.180 | 95.1 | 1.200 | 95.1 | 1.220 | 95.2 |
| 1.240 | 95.1 | 1.260 | 95.1 | 1.280 | 95.0 | 1.300 | 95.2 | 1.320 | 95.0 |
| 1.340 | 94.6 | 1.360 | 94.0 | 1.380 | 93.8 | 1.400 | 94.5 | 1.420 | 94.7 |
| 1.440 | 94.8 | 1.460 | 94.8 | 1.480 | 94.9 | 1.500 | 95.0 | 1.520 | 95.0 |
| 1.540 | 94.9 | 1.560 | 94.9 | 1.580 | 95.0 | 1.600 | 94.8 | 1.620 | 94.8 |
| 1.640 | 94.9 | 1.660 | 94.6 | 1.680 | 94.6 | 1.700 | 94.4 | 1.720 | 94.4 |
| 1.740 | 94.3 | 1.760 | 94.2 | 1.780 | 93.9 | 1.800 | 93.8 | 1.820 | 93.7 |
| 1.840 | 93.5 | 1.860 | 93.6 | 1.880 | 93.4 | 1.900 | 93.3 | 1.920 | 93.0 |
| 1.940 | 92.9 | 1.960 | 92.7 | 1.980 | 92.5 | 2.000 | 92.2 | 2.020 | 91.6 |
| 2.040 | 91.0 | 2.060 | 90.3 | 2.080 | 89.3 | 2.100 | 88.5 | 2.120 | 88.3 |
| 2.140 | 87.5 | 2.160 | 86.9 | 2.180 | 86.1 | 2.200 | 85.7 | 2.220 | 85.2 |
| 2.240 | 85.3 | 2.260 | 85.6 | 2.280 | 85.5 | 2.300 | 85.4 | 2.320 | 85.3 |
| 2.340 | 84.8 | 2.360 | 84.3 | 2.380 | 83.6 | 2.400 | 82.7 | 2.420 | 81.9 |
| 2.440 | 80.8 | 2.460 | 80.2 | 2.480 | 79.5 | 2.500 | 79.0 | | |

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FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, K-2 23 AUG 78 100280005

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU IN SITU, AFTER 503 HOU XPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.119

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 6.9 | 0.252 | 6.8 | 0.254 | 6.9 | 0.256 | 7.0 | 0.258 | 6.9 |
| 0.260 | 6.9 | 0.262 | 6.8 | 0.264 | 6.8 | 0.266 | 6.6 | 0.268 | 6.7 |
| 0.270 | 6.7 | 0.272 | 6.8 | 0.274 | 6.6 | 0.276 | 6.7 | 0.278 | 6.6 |
| 0.280 | 6.6 | 0.282 | 6.6 | 0.284 | 6.5 | 0.286 | 6.5 | 0.288 | 6.4 |
| 0.290 | 6.5 | 0.292 | 6.4 | 0.294 | 6.4 | 0.296 | 6.5 | 0.298 | 6.5 |
| 0.300 | 6.6 | 0.302 | 6.8 | 0.304 | 6.9 | 0.306 | 6.9 | 0.308 | 7.0 |
| 0.310 | 7.2 | 0.312 | 7.5 | 0.314 | 7.8 | 0.316 | 8.9 | 0.318 | 10.3 |
| 0.320 | 12.8 | 0.322 | 16.3 | 0.324 | 21.2 | 0.326 | 26.7 | 0.328 | 32.5 |
| 0.330 | 37.4 | 0.332 | 42.1 | 0.334 | 45.5 | 0.336 | 48.4 | 0.338 | 51.5 |
| 0.340 | 53.9 | 0.342 | 55.1 | 0.344 | 57.8 | 0.346 | 59.7 | 0.348 | 61.1 |
| 0.350 | 62.5 | 0.352 | 64.1 | 0.354 | 64.9 | 0.356 | 66.3 | 0.358 | 67.5 |
| 0.360 | 69.5 | 0.365 | 72.1 | 0.370 | 73.8 | 0.375 | 75.5 | 0.380 | 77.4 |
| 0.385 | 79.2 | 0.390 | 80.4 | 0.395 | 81.8 | 0.400 | 82.3 | 0.405 | 83.4 |
| 0.410 | 84.1 | 0.415 | 84.6 | 0.420 | 84.9 | 0.425 | 85.1 | 0.430 | 86.0 |
| 0.435 | 85.9 | 0.440 | 86.5 | 0.445 | 86.4 | 0.450 | 87.1 | 0.455 | 87.6 |
| 0.460 | 87.8 | 0.465 | 87.7 | 0.470 | 87.8 | 0.475 | 88.1 | 0.480 | 88.3 |
| 0.485 | 88.7 | 0.490 | 88.3 | 0.495 | 89.2 | 0.500 | 88.8 | 0.505 | 89.5 |
| 0.510 | 89.6 | 0.515 | 89.6 | 0.520 | 89.8 | 0.525 | 90.2 | 0.530 | 90.5 |
| 0.535 | 90.4 | 0.540 | 91.3 | 0.545 | 91.3 | 0.550 | 91.2 | 0.555 | 91.6 |
| 0.560 | 91.7 | 0.565 | 92.0 | 0.570 | 92.3 | 0.575 | 92.2 | 0.580 | 92.4 |
| 0.585 | 93.0 | 0.590 | 93.0 | 0.595 | 92.3 | 0.600 | 93.0 | 0.605 | 92.5 |
| 0.610 | 92.9 | 0.615 | 92.6 | 0.620 | 92.8 | 0.625 | 93.1 | 0.630 | 92.6 |
| 0.635 | 93.3 | 0.640 | 93.3 | 0.645 | 93.0 | 0.650 | 93.2 | 0.655 | 93.5 |
| 0.660 | 93.4 | 0.665 | 93.0 | 0.670 | 93.2 | 0.675 | 93.9 | 0.680 | 93.5 |
| 0.685 | 93.7 | 0.690 | 93.5 | 0.695 | 93.5 | 0.700 | 93.7 | 0.720 | 94.2 |
| 0.740 | 94.3 | 0.760 | 94.3 | 0.780 | 94.6 | 0.800 | 94.5 | 0.820 | 94.6 |
| 0.840 | 94.6 | 0.860 | 94.8 | 0.880 | 94.9 | 0.900 | 95.1 | 0.920 | 94.7 |
| 0.940 | 94.7 | 0.960 | 95.2 | 0.980 | 95.2 | 1.000 | 95.0 | 1.020 | 95.2 |
| 1.040 | 94.8 | 1.060 | 95.2 | 1.080 | 95.0 | 1.100 | 95.2 | 1.120 | 95.1 |
| 1.140 | 95.1 | 1.160 | 95.2 | 1.180 | 95.1 | 1.200 | 95.3 | 1.220 | 95.3 |
| 1.240 | 95.4 | 1.260 | 95.4 | 1.280 | 95.3 | 1.300 | 95.3 | 1.320 | 95.1 |
| 1.340 | 94.8 | 1.360 | 94.2 | 1.380 | 94.1 | 1.400 | 94.5 | 1.420 | 94.8 |
| 1.440 | 94.9 | 1.460 | 95.0 | 1.480 | 95.0 | 1.500 | 95.2 | 1.520 | 95.0 |
| 1.540 | 95.1 | 1.560 | 95.1 | 1.580 | 95.1 | 1.600 | 94.9 | 1.620 | 94.9 |
| 1.640 | 94.8 | 1.660 | 94.8 | 1.680 | 94.7 | 1.700 | 94.4 | 1.720 | 94.4 |
| 1.740 | 94.4 | 1.760 | 94.3 | 1.780 | 94.2 | 1.800 | 94.0 | 1.820 | 93.7 |
| 1.840 | 93.6 | 1.860 | 93.6 | 1.880 | 93.4 | 1.900 | 93.3 | 1.920 | 93.0 |
| 1.940 | 93.1 | 1.960 | 92.6 | 1.980 | 92.5 | 2.000 | 92.2 | 2.020 | 91.6 |
| 2.040 | 91.0 | 2.060 | 90.2 | 2.080 | 89.4 | 2.100 | 88.7 | 2.120 | 88.3 |
| 2.140 | 87.5 | 2.160 | 86.9 | 2.180 | 86.2 | 2.200 | 85.6 | 2.220 | 85.3 |
| 2.240 | 85.4 | 2.260 | 85.6 | 2.280 | 85.7 | 2.300 | 85.6 | 2.320 | 85.3 |
| 2.340 | 84.9 | 2.360 | 84.2 | 2.380 | 83.4 | 2.400 | 82.8 | 2.420 | 81.8 |
| 2.440 | 80.6 | 2.460 | 80.3 | 2.480 | 79.5 | 2.500 | 79.0 | | |

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, A-1 23 AUG 78 440140001

AND ELECTRONS ON THE REFLECTANCE OF 7940 FUSED SILICA IN SITU IN VACUUM, BEFORE EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.078

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 21.6 | 0.252 | 21.5 | 0.254 | 21.4 | 0.256 | 21.4 | 0.258 | 21.2 |
| 0.260 | 20.9 | 0.262 | 20.9 | 0.264 | 20.5 | 0.266 | 20.3 | 0.268 | 20.2 |
| 0.270 | 19.9 | 0.272 | 19.6 | 0.274 | 19.1 | 0.276 | 18.7 | 0.278 | 18.2 |
| 0.280 | 18.0 | 0.282 | 17.6 | 0.284 | 16.9 | 0.286 | 16.5 | 0.288 | 15.9 |
| 0.290 | 15.6 | 0.292 | 15.0 | 0.294 | 14.2 | 0.296 | 13.4 | 0.298 | 12.8 |
| 0.300 | 11.6 | 0.302 | 10.9 | 0.304 | 9.9 | 0.306 | 9.2 | 0.308 | 8.7 |
| 0.310 | 8.3 | 0.312 | 8.6 | 0.314 | 9.3 | 0.316 | 10.4 | 0.318 | 12.9 |
| 0.320 | 17.0 | 0.322 | 23.0 | 0.324 | 30.2 | 0.326 | [illegible] | 0.328 | 48.3 |
| 0.330 | [illegible] | 0.332 | 63.2 | 0.334 | 67.4 | 0.336 | 70.2 | 0.338 | 73.7 |
| 0.340 | 75.4 | 0.342 | 77.8 | 0.344 | 79.4 | 0.346 | 81.2 | 0.348 | 82.1 |
| 0.350 | 82.7 | 0.352 | 83.4 | 0.354 | 84.1 | 0.356 | 85.3 | 0.358 | 86.8 |
| 0.360 | 86.9 | 0.365 | 88.6 | 0.370 | 89.5 | 0.375 | 90.3 | 0.380 | 91.3 |
| 0.385 | 92.5 | 0.390 | 92.9 | 0.395 | [illegible] | 0.400 | 93.6 | 0.405 | 93.7 |
| 0.410 | 94.3 | 0.415 | 94.8 | 0.420 | 95.2 | 0.425 | [illegible] | 0.430 | 95.7 |
| 0.435 | 95.7 | 0.440 | 95.9 | 0.445 | 95.2 | 0.450 | 95.5 | 0.455 | 95.9 |
| 0.460 | 96.0 | 0.465 | 95.7 | 0.470 | 95.5 | 0.475 | 95.3 | 0.480 | 95.6 |
| 0.485 | 95.2 | 0.490 | 95.6 | 0.495 | 95.4 | 0.500 | [illegible] | 0.505 | 95.8 |
| 0.510 | 95.0 | 0.515 | 95.2 | 0.520 | 95.3 | 0.525 | 95.3 | 0.530 | 95.7 |
| 0.535 | 95.6 | 0.540 | 95.8 | 0.545 | 95.5 | 0.550 | 95.3 | 0.555 | 95.8 |
| 0.560 | 95.7 | 0.565 | 95.8 | 0.570 | 95.9 | 0.575 | 95.9 | 0.580 | 95.8 |
| 0.585 | 96.3 | 0.590 | 96.1 | 0.595 | 96.1 | 0.600 | 96.2 | 0.605 | 95.9 |
| 0.610 | 96.0 | 0.615 | 96.2 | 0.620 | 95.9 | 0.625 | 96.1 | 0.630 | 96.0 |
| 0.635 | 96.0 | 0.640 | 96.0 | 0.645 | 96.1 | 0.650 | 95.8 | 0.655 | 95.6 |
| 0.660 | 96.0 | 0.665 | 96.0 | 0.670 | 95.9 | 0.675 | 95.8 | 0.680 | 95.8 |
| 0.685 | 95.8 | 0.690 | 95.7 | 0.695 | 96.0 | 0.700 | 95.9 | 0.720 | 95.5 |
| 0.740 | 95.7 | 0.760 | 95.6 | 0.780 | 95.5 | 0.800 | 95.4 | 0.820 | 95.5 |
| 0.840 | 95.4 | 0.860 | 95.7 | 0.880 | 95.7 | 0.900 | 95.7 | 0.920 | 95.7 |
| 0.940 | 95.5 | 0.960 | 95.8 | 0.980 | 95.9 | 1.000 | 95.7 | 1.020 | 95.9 |
| 1.040 | 95.6 | 1.060 | 95.8 | 1.080 | 95.7 | 1.100 | 95.9 | 1.120 | 95.7 |
| 1.140 | 95.7 | 1.160 | 95.9 | 1.180 | 95.6 | 1.200 | 95.8 | 1.220 | 95.7 |
| 1.240 | 95.7 | 1.260 | 95.9 | 1.280 | 95.6 | 1.300 | [illegible] | 1.320 | 94.6 |
| 1.340 | 92.9 | 1.360 | 92.3 | 1.380 | [illegible] | 1.400 | 95.5 | 1.420 | 95.9 |
| 1.440 | 96.0 | 1.460 | 96.0 | 1.480 | 95.9 | 1.500 | 96.2 | 1.520 | 96.1 |
| 1.540 | [illegible] | 1.560 | 96.2 | 1.580 | 96.2 | 1.600 | 96.1 | 1.620 | 96.2 |
| 1.640 | 96.3 | 1.660 | 96.3 | 1.680 | 96.4 | 1.700 | 96.3 | 1.720 | 96.3 |
| 1.740 | 96.4 | 1.760 | 96.4 | 1.780 | 96.3 | 1.800 | 96.3 | 1.820 | 96.3 |
| 1.840 | 96.3 | 1.860 | 96.4 | 1.880 | 96.6 | 1.900 | 96.7 | 1.920 | 96.5 |
| 1.940 | 96.7 | 1.960 | 96.5 | 1.980 | 96.5 | 2.000 | [illegible] | 2.020 | 96.2 |
| 2.040 | 96.1 | 2.060 | 95.8 | 2.080 | 95.5 | 2.100 | 95.2 | 2.120 | 94.4 |
| 2.140 | 92.2 | 2.160 | 88.3 | 2.180 | 83.6 | 2.200 | 80.0 | 2.220 | 79.3 |
| 2.240 | 81.3 | 2.260 | 85.0 | 2.280 | 88.4 | 2.300 | 91.1 | 2.320 | 92.7 |
| 2.340 | 93.5 | 2.360 | 93.5 | 2.380 | 93.2 | 2.400 | 92.4 | 2.420 | 91.4 |
| 2.440 | 89.6 | 2.460 | 88.4 | 2.480 | 86.1 | 2.500 | 83.9 | | |

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, 4-1 23 AUG 78 080140002

AND ELECTRONS ON THE REFLECTANCE OF 7940 FUSED SILICA IN SITU IN SITU, AFTER 50 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.080

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 21.6 | 0.252 | 21.5 | 0.254 | 21.4 | 0.256 | 21.2 | 0.258 | 21.0 |
| 0.260 | 20.9 | 0.262 | 20.7 | 0.264 | 20.5 | 0.266 | 20.3 | 0.268 | 19.9 |
| 0.270 | 19.8 | 0.272 | 19.4 | 0.274 | 18.9 | 0.276 | 18.7 | 0.278 | 18.2 |
| 0.280 | 17.8 | 0.282 | 17.5 | 0.284 | 16.9 | 0.286 | 16.4 | 0.288 | 16.0 |
| 0.290 | 15.3 | 0.292 | 14.9 | 0.294 | 14.1 | 0.296 | 13.3 | 0.298 | 12.7 |
| 0.300 | 11.7 | 0.302 | 10.7 | 0.304 | 9.7 | 0.306 | 9.0 | 0.308 | 8.6 |
| 0.310 | 8.4 | 0.312 | 8.5 | 0.314 | 9.2 | 0.316 | 10.3 | 0.318 | 13.0 |
| 0.320 | 16.8 | 0.322 | 22.6 | 0.324 | 30.1 | 0.326 | 39.1 | 0.328 | 48.0 |
| 0.330 | 56.3 | 0.332 | 62.8 | 0.334 | 67.1 | 0.336 | 70.5 | 0.338 | 73.5 |
| 0.340 | 75.8 | 0.342 | 77.0 | 0.344 | 79.1 | 0.346 | 80.2 | 0.348 | 81.1 |
| 0.350 | 82.0 | 0.352 | 83.8 | 0.354 | 84.3 | 0.356 | 85.5 | 0.358 | 86.0 |
| 0.360 | 86.0 | 0.365 | 87.3 | 0.370 | 88.5 | 0.375 | 89.1 | 0.380 | 90.5 |
| 0.385 | 91.3 | 0.390 | 91.4 | 0.395 | 92.0 | 0.400 | 92.5 | 0.405 | 93.1 |
| 0.410 | 93.5 | 0.415 | 93.6 | 0.420 | 94.0 | 0.425 | 94.2 | 0.430 | 94.7 |
| 0.435 | 94.8 | 0.440 | 95.1 | 0.445 | 94.6 | 0.450 | 95.1 | 0.455 | 95.3 |
| 0.460 | 94.8 | 0.465 | 95.1 | 0.470 | 94.6 | 0.475 | 94.6 | 0.480 | 95.0 |
| 0.485 | 94.8 | 0.490 | 94.5 | 0.495 | 95.0 | 0.500 | 94.4 | 0.505 | 95.2 |
| 0.510 | 94.8 | 0.515 | 95.2 | 0.520 | 94.9 | 0.525 | 94.8 | 0.530 | 95.0 |
| 0.535 | 95.1 | 0.540 | 95.2 | 0.545 | 95.1 | 0.550 | 95.4 | 0.555 | 95.5 |
| 0.560 | 95.1 | 0.565 | 95.9 | 0.570 | 95.8 | 0.575 | 95.3 | 0.580 | 95.8 |
| 0.585 | 96.1 | 0.590 | 96.2 | 0.595 | 95.7 | 0.600 | 96.1 | 0.605 | 95.7 |
| 0.610 | 95.8 | 0.615 | 95.7 | 0.620 | 96.0 | 0.625 | 96.0 | 0.630 | 95.7 |
| 0.635 | 95.7 | 0.640 | 95.7 | 0.645 | 95.4 | 0.650 | 95.9 | 0.655 | 95.4 |
| 0.660 | 96.0 | 0.665 | 95.7 | 0.670 | 95.6 | 0.675 | 95.9 | 0.680 | 95.7 |
| 0.685 | 95.9 | 0.690 | 95.8 | 0.695 | 95.8 | 0.700 | 96.0 | 0.720 | 95.8 |
| 0.740 | 95.7 | 0.760 | 95.8 | 0.780 | 95.9 | 0.800 | 95.5 | 0.820 | 95.5 |
| 0.840 | 95.4 | 0.850 | 95.5 | 0.880 | 95.5 | 0.900 | 95.7 | 0.920 | 95.7 |
| 0.940 | 95.5 | 0.960 | 95.9 | 0.980 | 95.8 | 1.000 | 95.7 | 1.020 | 95.9 |
| 1.040 | 95.6 | 1.060 | 95.8 | 1.080 | 95.9 | 1.100 | 96.1 | 1.120 | 95.9 |
| 1.140 | 95.7 | 1.160 | 95.8 | 1.180 | 95.8 | 1.200 | 95.8 | 1.220 | 95.8 |
| 1.240 | 95.8 | 1.260 | 95.8 | 1.280 | 95.6 | 1.300 | 95.6 | 1.320 | 94.7 |
| 1.340 | 92.7 | 1.360 | 92.2 | 1.380 | 93.7 | 1.400 | 95.4 | 1.420 | 95.8 |
| 1.440 | 95.9 | 1.460 | 96.0 | 1.480 | 96.0 | 1.500 | 96.2 | 1.520 | 96.1 |
| 1.540 | 96.0 | 1.560 | 96.0 | 1.580 | 96.2 | 1.600 | 96.1 | 1.620 | 96.2 |
| 1.640 | 96.3 | 1.660 | 96.2 | 1.680 | 96.3 | 1.700 | 96.2 | 1.720 | 96.1 |
| 1.740 | 96.4 | 1.760 | 96.2 | 1.780 | 96.1 | 1.800 | 96.1 | 1.820 | 96.1 |
| 1.840 | 96.1 | 1.860 | 96.3 | 1.880 | 96.3 | 1.900 | 96.5 | 1.920 | 96.4 |
| 1.940 | 96.6 | 1.960 | 96.4 | 1.980 | 96.3 | 2.000 | 96.2 | 2.020 | 95.7 |
| 2.040 | 95.5 | 2.060 | 95.6 | 2.080 | 95.4 | 2.100 | 94.9 | 2.120 | 94.1 |
| 2.140 | 92.0 | 2.160 | 88.1 | 2.180 | 83.6 | 2.200 | 79.9 | 2.220 | 79.3 |
| 2.240 | 81.3 | 2.260 | 84.8 | 2.280 | 88.2 | 2.300 | 90.7 | 2.320 | 92.5 |
| 2.340 | 93.1 | 2.360 | 93.4 | 2.380 | 92.9 | 2.400 | 97.1 | 2.420 | 91.0 |
| 2.440 | 89.5 | 2.460 | 88.2 | 2.480 | 85.8 | 2.500 | 83.5 | | |

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, 4-1 23 AUG 78 440140003

AND ELECTRONS ON THE REFLECTANCE OF 7940 FUSED SILICA IN SITU IN SITU, AFTER 154 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.081

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 21.3 | 0.252 | 21.3 | 0.254 | 21.0 | 0.256 | 21.4 | 0.258 | 20.8 |
| 0.260 | 20.9 | 0.262 | 20.6 | 0.264 | 20.3 | 0.266 | 20.1 | 0.268 | 19.8 |
| 0.270 | 19.6 | 0.272 | 19.3 | 0.274 | 18.9 | 0.276 | 18.6 | 0.278 | 18.1 |
| 0.280 | 18.0 | 0.282 | 17.4 | 0.284 | 17.0 | 0.286 | 16.5 | 0.288 | 16.1 |
| 0.290 | 15.5 | 0.292 | 14.8 | 0.294 | 14.2 | 0.296 | 13.5 | 0.298 | 12.6 |
| 0.300 | 11.8 | 0.302 | 11.1 | 0.304 | 10.1 | 0.306 | 9.3 | 0.308 | 8.9 |
| 0.310 | 8.7 | 0.312 | 8.9 | 0.314 | 9.7 | 0.316 | 10.9 | 0.318 | 13.4 |
| 0.320 | 17.3 | 0.322 | 22.9 | 0.324 | 30.8 | 0.326 | 39.3 | 0.328 | 48.6 |
| 0.330 | 54.1 | 0.332 | 61.7 | 0.334 | 66.5 | 0.336 | 69.4 | 0.338 | 72.4 |
| 0.340 | 74.9 | 0.342 | 76.4 | 0.344 | 77.6 | 0.346 | 78.7 | 0.348 | 80.2 |
| 0.350 | 81.4 | 0.352 | 82.1 | 0.354 | 83.3 | 0.356 | 83.7 | 0.358 | 85.2 |
| 0.360 | 85.6 | 0.365 | 86.8 | 0.370 | 88.2 | 0.375 | 89.2 | 0.380 | 90.5 |
| 0.385 | 90.9 | 0.390 | 91.4 | 0.395 | 92.1 | 0.400 | 92.4 | 0.405 | 92.6 |
| 0.410 | 93.4 | 0.415 | 93.7 | 0.420 | 94.1 | 0.425 | 94.2 | 0.430 | 94.5 |
| 0.435 | 94.3 | 0.440 | 94.9 | 0.445 | 94.5 | 0.450 | 95.0 | 0.455 | 95.3 |
| 0.460 | 95.4 | 0.465 | 95.1 | 0.470 | 95.1 | 0.475 | 94.8 | 0.480 | 95.2 |
| 0.485 | 95.0 | 0.490 | 94.9 | 0.495 | 95.2 | 0.500 | 95.0 | 0.505 | 95.4 |
| 0.510 | 94.8 | 0.515 | 95.0 | 0.520 | 94.9 | 0.525 | 95.2 | 0.530 | 95.6 |
| 0.535 | 95.2 | 0.540 | 95.2 | 0.545 | 95.6 | 0.550 | 95.5 | 0.555 | 95.6 |
| 0.560 | 95.2 | 0.565 | 95.8 | 0.570 | 95.8 | 0.575 | 95.6 | 0.580 | 95.6 |
| 0.585 | 96.0 | 0.590 | 96.0 | 0.595 | 95.9 | 0.600 | 96.0 | 0.605 | 95.9 |
| 0.610 | 96.2 | 0.615 | 95.8 | 0.620 | 95.9 | 0.625 | 96.2 | 0.630 | 95.9 |
| 0.635 | 96.1 | 0.640 | 95.9 | 0.645 | 95.5 | 0.650 | 95.8 | 0.655 | 95.7 |
| 0.660 | 95.5 | 0.665 | 95.6 | 0.670 | 95.6 | 0.675 | 95.7 | 0.680 | 95.9 |
| 0.685 | 95.8 | 0.690 | 95.7 | 0.695 | 95.8 | 0.700 | 95.9 | 0.720 | 95.2 |
| 0.740 | 95.1 | 0.760 | 95.2 | 0.780 | 95.2 | 0.800 | 95.1 | 0.820 | 95.2 |
| 0.840 | 95.1 | 0.860 | 95.4 | 0.880 | 95.5 | 0.900 | 95.5 | 0.920 | 95.6 |
| 0.940 | 95.4 | 0.960 | 95.6 | 0.980 | 95.7 | 1.000 | 95.6 | 1.020 | 95.9 |
| 1.040 | 95.5 | 1.060 | 95.8 | 1.080 | 95.9 | 1.100 | 95.9 | 1.120 | 95.8 |
| 1.140 | 95.5 | 1.160 | 95.8 | 1.180 | 95.6 | 1.200 | 95.8 | 1.220 | 95.8 |
| 1.240 | 95.7 | 1.260 | 95.9 | 1.280 | 95.7 | 1.300 | 95.6 | 1.320 | 98.6 |
| 1.340 | 92.9 | 1.360 | 92.5 | 1.380 | 93.7 | 1.400 | 95.6 | 1.420 | 95.9 |
| 1.440 | 96.0 | 1.460 | 96.0 | 1.480 | 96.0 | 1.500 | 96.2 | 1.520 | 96.2 |
| 1.540 | 96.1 | 1.560 | 96.2 | 1.580 | 96.3 | 1.600 | 96.2 | 1.620 | 96.4 |
| 1.640 | 96.5 | 1.660 | 96.5 | 1.680 | 96.4 | 1.700 | 96.3 | 1.720 | 96.4 |
| 1.740 | 96.5 | 1.760 | 96.3 | 1.780 | 96.3 | 1.800 | 96.3 | 1.820 | 96.3 |
| 1.840 | 96.4 | 1.860 | 96.4 | 1.880 | 96.4 | 1.900 | 96.7 | 1.920 | 96.5 |
| 1.940 | 95.7 | 1.960 | 96.6 | 1.980 | 96.5 | 2.000 | 96.3 | 2.020 | 96.2 |
| 2.040 | 95.9 | 2.060 | 95.9 | 2.080 | 95.5 | 2.100 | 95.1 | 2.120 | 94.4 |
| 2.140 | 92.1 | 2.160 | 88.2 | 2.180 | 84.0 | 2.200 | 80.6 | 2.220 | 79.9 |
| 2.240 | 91.6 | 2.260 | 85.1 | 2.280 | 88.4 | 2.300 | 91.0 | 2.320 | 92.5 |
| 2.340 | 93.2 | 2.360 | 93.4 | 2.380 | 93.1 | 2.400 | 92.3 | 2.420 | 91.1 |
| 2.440 | 89.5 | 2.460 | 88.2 | 2.480 | 85.9 | 2.500 | 83.7 | | |

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FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, 4-1 23 AUG 78 88C140008

AND ELECTRONS ON THE REFLECTANCE OF 7940 FUSED SILICA IN SITU IN SITU, AFTER 313 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S' = 0.088

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 21.0 | 0.252 | 20.7 | 0.254 | 21.0 | 0.256 | 21.0 | 0.258 | 20.1 |
| 0.260 | 20.4 | 0.262 | 20.2 | 0.264 | 20.0 | 0.266 | 19.7 | 0.268 | 19.2 |
| 0.270 | 19.5 | 0.272 | 19.3 | 0.274 | 18.9 | 0.276 | 18.3 | 0.278 | 17.9 |
| 0.280 | 17.5 | 0.282 | 17.2 | 0.284 | 16.7 | 0.286 | 16.0 | 0.288 | 15.7 |
| 0.290 | 15.1 | 0.292 | 14.7 | 0.294 | 14.3 | 0.296 | 13.4 | 0.298 | 12.5 |
| 0.300 | 11.6 | 0.302 | 10.9 | 0.304 | 10.0 | 0.306 | 9.3 | 0.308 | 8.9 |
| 0.310 | 8.6 | 0.312 | 8.8 | 0.314 | 9.2 | 0.316 | 10.6 | 0.318 | 13.1 |
| 0.320 | 16.7 | 0.322 | 22.8 | 0.324 | 29.9 | 0.326 | 38.4 | 0.328 | 47.2 |
| 0.330 | 55.7 | 0.332 | 61.0 | 0.334 | 65.5 | 0.336 | 68.8 | 0.338 | 71.5 |
| 0.340 | 73.5 | 0.342 | 75.3 | 0.344 | 77.2 | 0.346 | 77.9 | 0.348 | 79.6 |
| 0.350 | 80.6 | 0.352 | 80.8 | 0.354 | 82.0 | 0.356 | 83.3 | 0.358 | 83.3 |
| 0.360 | 83.8 | 0.365 | 84.9 | 0.370 | 86.2 | 0.375 | 87.4 | 0.380 | 88.4 |
| 0.385 | 89.4 | 0.390 | 90.0 | 0.395 | 90.6 | 0.400 | 90.8 | 0.405 | 91.4 |
| 0.410 | 92.4 | 0.415 | 92.2 | 0.420 | 92.9 | 0.425 | 93.1 | 0.430 | 93.3 |
| 0.435 | 93.6 | 0.440 | 93.6 | 0.445 | 93.4 | 0.450 | 93.9 | 0.455 | 94.3 |
| 0.460 | 94.3 | 0.465 | 94.0 | 0.470 | 94.2 | 0.475 | 93.7 | 0.480 | 94.2 |
| 0.485 | 93.8 | 0.490 | 93.8 | 0.495 | 94.3 | 0.500 | 94.2 | 0.505 | 94.4 |
| 0.510 | 94.1 | 0.515 | 94.5 | 0.520 | 94.4 | 0.525 | 94.2 | 0.530 | 94.6 |
| 0.535 | 94.4 | 0.540 | 95.0 | 0.545 | 95.2 | 0.550 | 94.9 | 0.555 | 95.0 |
| 0.560 | 94.9 | 0.565 | 95.0 | 0.570 | 95.1 | 0.575 | 95.4 | 0.580 | 95.1 |
| 0.585 | 95.7 | 0.590 | 95.6 | 0.595 | 95.6 | 0.600 | 95.7 | 0.605 | 95.5 |
| 0.610 | 95.4 | 0.615 | 95.4 | 0.620 | 95.5 | 0.625 | 95.8 | 0.630 | 95.4 |
| 0.635 | 95.4 | 0.640 | 95.6 | 0.645 | 95.2 | 0.650 | 95.3 | 0.655 | 95.1 |
| 0.660 | 95.6 | 0.665 | 95.4 | 0.670 | 95.4 | 0.675 | 95.6 | 0.680 | 95.5 |
| 0.685 | 95.4 | 0.690 | 95.4 | 0.695 | 94.5 | 0.700 | 95.7 | 0.720 | 94.7 |
| 0.740 | 94.9 | 0.760 | 94.7 | 0.780 | 94.8 | 0.800 | 94.5 | 0.820 | 94.5 |
| 0.840 | 94.5 | 0.860 | 94.8 | 0.880 | 94.6 | 0.900 | 95.0 | 0.920 | 94.8 |
| 0.940 | 94.7 | 0.960 | 95.1 | 0.980 | 95.3 | 1.000 | 95.0 | 1.020 | 95.3 |
| 1.040 | 94.8 | 1.060 | 95.0 | 1.080 | 95.2 | 1.100 | 95.3 | 1.120 | 95.2 |
| 1.140 | 95.1 | 1.160 | 95.1 | 1.180 | 95.1 | 1.200 | 95.0 | 1.220 | 95.2 |
| 1.240 | 95.1 | 1.260 | 95.2 | 1.280 | 95.0 | 1.300 | 94.9 | 1.320 | 93.9 |
| 1.340 | 92.1 | 1.360 | 91.8 | 1.380 | 93.2 | 1.400 | 94.8 | 1.420 | 95.2 |
| 1.440 | 95.3 | 1.460 | 95.4 | 1.480 | 95.4 | 1.500 | 95.5 | 1.520 | 95.4 |
| 1.540 | 95.4 | 1.560 | 95.4 | 1.580 | 95.6 | 1.600 | 95.5 | 1.620 | 95.6 |
| 1.640 | 95.6 | 1.660 | 95.6 | 1.680 | 95.7 | 1.700 | 95.7 | 1.720 | 95.6 |
| 1.740 | 95.8 | 1.760 | 95.8 | 1.780 | 95.6 | 1.800 | 95.6 | 1.820 | 95.6 |
| 1.840 | 95.6 | 1.860 | 95.8 | 1.880 | 95.8 | 1.900 | 95.9 | 1.920 | 95.8 |
| 1.940 | 96.0 | 1.960 | 95.9 | 1.980 | 95.9 | 2.000 | 95.8 | 2.020 | 95.4 |
| 2.040 | 95.2 | 2.060 | 95.1 | 2.080 | 94.9 | 2.100 | 94.4 | 2.120 | 93.6 |
| 2.140 | 91.0 | 2.160 | 87.7 | 2.180 | 83.1 | 2.200 | 79.9 | 2.220 | 79.6 |
| 2.240 | 81.0 | 2.260 | 84.3 | 2.280 | 87.5 | 2.300 | 90.1 | 2.320 | 91.8 |
| 2.340 | 92.6 | 2.360 | 92.7 | 2.380 | 92.1 | 2.400 | 91.5 | 2.420 | 90.3 |
| 2.440 | 88.7 | 2.460 | 87.3 | 2.480 | 85.2 | 2.500 | 83.0 | | |

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, 4-1 23 AUG 78 880180005

AND ELECTRONS ON THE REFLECTANCE OF 7940 FUSED SILICA IN SITU IN SITU, AFTER 503 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.087

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 20.5 | 0.252 | 20.1 | 0.254 | 2[illegible] | 0.256 | 20.4 | 0.258 | 20.2 |
| 0.260 | 19.8 | 0.262 | 19.9 | 0.264 | 19.6 | 0.266 | 19.3 | 0.268 | 19.5 |
| 0.270 | 18.8 | 0.272 | 18.6 | 0.274 | 18.5 | 0.276 | 18.1 | 0.278 | 17.5 |
| 0.280 | 17.2 | 0.282 | 16.7 | 0.284 | 16.4 | 0.286 | 15.9 | 0.288 | 15.7 |
| 0.290 | 15.1 | 0.292 | 14.5 | 0.294 | 14.1 | 0.296 | 13.3 | 0.298 | 12.5 |
| 0.300 | 11.7 | 0.302 | 10.9 | 0.304 | 10.0 | 0.306 | 9.4 | 0.308 | 8.8 |
| 0.310 | 8.7 | 0.312 | 8.9 | 0.314 | 9.5 | 0.316 | 10.6 | 0.318 | 13.0 |
| 0.320 | 17.2 | 0.322 | 22.4 | 0.324 | 29.8 | 0.326 | 38.4 | 0.328 | 46.4 |
| 0.330 | 54.2 | 0.332 | 59.7 | 0.334 | 63.5 | 0.336 | 67.2 | 0.338 | 69.8 |
| 0.340 | 72.2 | 0.342 | [illegible]3.3 | 0.344 | 75.0 | 0.346 | 74.4 | 0.348 | 77.6 |
| 0.350 | 78.0 | 0.352 | 79.6 | 0.354 | 79.8 | 0.356 | 81.3 | 0.358 | 81.9 |
| 0.360 | 82.6 | 0.365 | 84.1 | 0.370 | 85.3 | 0.375 | 86.2 | 0.380 | 87.6 |
| 0.385 | 88.1 | 0.390 | 89.2 | 0.395 | 89.6 | 0.400 | 90.1 | 0.405 | 91.0 |
| 0.410 | 91.3 | 0.415 | 91.6 | 0.420 | 92.1 | 0.425 | 92.2 | 0.430 | 92.9 |
| 0.435 | 92.8 | 0.440 | 93.0 | 0.445 | 93.1 | 0.450 | 93.4 | 0.455 | 93.6 |
| 0.460 | 93.9 | 0.465 | 93.5 | 0.470 | 93.7 | 0.475 | 93.7 | 0.480 | 93.9 |
| 0.485 | 93.7 | 0.490 | 93.6 | 0.495 | 94.1 | 0.500 | 93.3 | 0.505 | 94.3 |
| 0.510 | 94.0 | 0.515 | 94.0 | 0.520 | 94.1 | 0.525 | 94.3 | 0.530 | 94.3 |
| 0.535 | 94.2 | 0.540 | 94.9 | 0.545 | 95.1 | 0.550 | 94.8 | 0.555 | 94.8 |
| 0.560 | 94.7 | 0.565 | 95.1 | 0.570 | 95.2 | 0.575 | 95.3 | 0.580 | 95.0 |
| 0.585 | 95.9 | 0.590 | 96.0 | 0.595 | 95.2 | 0.600 | 95.6 | 0.605 | 95.4 |
| 0.610 | 95.6 | 0.615 | 95.1 | 0.620 | 95.4 | 0.625 | 95.4 | 0.630 | 95.2 |
| 0.635 | 95.8 | 0.640 | 95.4 | 0.645 | [illegible]5.0 | 0.650 | 95.2 | 0.655 | 95.5 |
| 0.660 | 95.5 | 0.665 | 94.8 | 0.670 | 95.[illegible] | 0.675 | 95.5 | 0.680 | 95.5 |
| 0.685 | 95.4 | 0.690 | 95.1 | 0.695 | 95.4 | 0.700 | 95.4 | 0.720 | 95.0 |
| 0.740 | 95.1 | 0.760 | 95.0 | 0.780 | 95.1 | 0.800 | 95.0 | 0.820 | 95.2 |
| 0.840 | 95.2 | 0.860 | 95.4 | 0.880 | 95.4 | 0.900 | 95.4 | 0.920 | 95.4 |
| 0.940 | 95.2 | 0.960 | 95.8 | 0.980 | 95.7 | 1.000 | 95.5 | 1.020 | 95.7 |
| 1.040 | 95.4 | 1.060 | 95.7 | 1.080 | 95.6 | 1.100 | 95.9 | 1.120 | 95.7 |
| 1.140 | 95.6 | 1.160 | 95.8 | 1.180 | 95.6 | 1.200 | 95.[illegible] | 1.220 | 95.7 |
| 1.240 | 95.8 | 1.260 | 95.8 | 1.280 | 95.7 | 1.300 | 95.4 | 1.320 | 94.3 |
| 1.340 | 92.9 | 1.360 | 92.3 | 1.380 | 93.4 | 1.400 | 95.3 | 1.420 | 95.8 |
| 1.440 | 95.8 | 1.460 | 95.9 | 1.480 | 95.9 | 1.500 | 96.1 | 1.520 | 96.0 |
| 1.540 | 96.1 | 1.560 | 96.1 | 1.580 | 96.2 | 1.600 | 96.0 | 1.620 | 96.2 |
| 1.640 | 96.1 | 1.660 | 96.1 | 1.680 | 96.2 | 1.700 | 96.1 | 1.720 | 96.1 |
| 1.740 | 96.3 | 1.760 | 96.2 | 1.780 | 96.2 | 1.800 | 96.1 | 1.820 | 96.1 |
| 1.840 | 96.1 | 1.860 | 96.3 | 1.880 | 96.2 | 1.900 | 96.4 | 1.920 | 96.3 |
| 1.940 | 96.4 | 1.960 | 96.2 | 1.980 | 96.2 | 2.000 | 96.1 | 2.020 | 95.8 |
| 2.040 | 95.6 | 2.060 | 95.5 | 2.080 | 95.5 | 2.100 | 94.9 | 2.120 | 94.0 |
| 2.140 | 91.7 | 2.160 | 88.0 | 2.180 | 83.9 | 2.200 | 80.9 | 2.220 | 80.1 |
| 2.240 | 81.4 | 2.260 | 84.3 | 2.280 | 87.6 | 2.300 | 90.4 | 2.320 | 92.1 |
| 2.340 | 92.9 | 2.360 | 93.1 | 2.380 | 92.7 | 2.400 | 91.8 | 2.420 | 90.8 |
| 2.440 | 89.2 | 2.460 | 87.8 | 2.480 | 85.7 | 2.500 | 83.5 | | |

AND ELECTRONS ON THE REFLECTANCE OF SAPPHIRE IN SITU IN VACUUM, BEFORE EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.109

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 20.6 | 0.252 | 20.5 | 0.254 | 20.5 | 0.256 | 20.4 | 0.258 | 20.4 |
| 0.260 | 20.3 | 0.262 | 20.1 | 0.264 | 20.0 | 0.266 | 19.8 | 0.268 | 19.5 |
| 0.270 | 19.2 | 0.272 | 19.2 | 0.274 | 18.9 | 0.276 | 18.5 | 0.278 | 18.2 |
| 0.280 | 17.9 | 0.282 | 17.7 | 0.284 | 17.2 | 0.286 | 17.0 | 0.288 | 16.4 |
| 0.290 | 16.2 | 0.292 | 15.6 | 0.294 | 15.3 | 0.296 | 14.6 | 0.298 | 14.2 |
| 0.300 | 13.6 | 0.302 | 13.1 | 0.304 | 12.7 | 0.306 | 12.4 | 0.308 | 12.3 |
| 0.310 | 12.3 | 0.312 | 13.2 | 0.314 | 14.2 | 0.316 | 15.8 | 0.318 | 18.3 |
| 0.320 | 22.2 | 0.322 | 27.8 | 0.324 | 34.0 | 0.326 | 41.8 | 0.328 | 48.6 |
| 0.330 | 54.8 | 0.332 | 59.4 | 0.334 | 62.6 | 0.336 | 63.9 | 0.338 | 66.0 |
| 0.340 | 67.5 | 0.342 | 68.1 | 0.344 | 69.3 | 0.346 | 70.0 | 0.348 | 70.6 |
| 0.350 | 71.2 | 0.352 | 71.5 | 0.354 | 71.7 | 0.356 | 72.4 | 0.358 | 73.4 |
| 0.360 | 73.3 | 0.365 | 74.0 | 0.370 | 74.8 | 0.375 | 75.7 | 0.380 | 76.7 |
| 0.385 | 78.1 | 0.390 | 78.6 | 0.395 | 79.5 | 0.400 | 80.4 | 0.405 | 81.0 |
| 0.410 | 82.2 | 0.415 | 83.0 | 0.420 | 83.6 | 0.425 | 84.2 | 0.430 | 85.4 |
| 0.435 | 85.6 | 0.440 | 86.7 | 0.445 | 86.3 | 0.450 | 86.9 | 0.455 | 87.6 |
| 0.460 | 88.2 | 0.465 | 88.2 | 0.470 | 88.3 | 0.475 | 88.2 | 0.480 | 88.9 |
| 0.485 | 88.9 | 0.490 | 89.3 | 0.495 | 89.1 | 0.500 | 89.6 | 0.505 | 89.9 |
| 0.510 | 89.6 | 0.515 | 90.0 | 0.520 | 89.9 | 0.525 | 90.3 | 0.530 | 90.5 |
| 0.535 | 90.6 | 0.540 | 90.8 | 0.545 | 91.1 | 0.550 | 90.8 | 0.555 | 91.4 |
| 0.560 | 91.4 | 0.565 | 91.8 | 0.570 | 91.7 | 0.575 | 92.1 | 0.580 | 92.2 |
| 0.585 | 92.7 | 0.590 | 92.6 | 0.595 | 92.3 | 0.600 | 92.7 | 0.605 | 92.6 |
| 0.610 | 92.9 | 0.615 | 92.9 | 0.620 | 92.9 | 0.625 | 93.2 | 0.630 | 92.9 |
| 0.635 | 93.0 | 0.640 | 93.0 | 0.645 | 93.2 | 0.650 | 93.0 | 0.655 | 92.8 |
| 0.660 | 93.1 | 0.665 | 93.0 | 0.670 | 92.9 | 0.675 | 92.9 | 0.680 | 92.9 |
| 0.685 | 93.0 | 0.690 | 92.9 | 0.695 | 93.0 | 0.700 | 92.9 | 0.720 | 93.1 |
| 0.740 | 93.1 | 0.760 | 93.3 | 0.780 | 93.3 | 0.800 | 93.3 | 0.820 | 93.4 |
| 0.840 | 93.5 | 0.860 | 93.8 | 0.880 | 93.8 | 0.900 | 94.0 | 0.920 | 94.1 |
| 0.940 | 94.0 | 0.960 | 94.3 | 0.980 | 94.4 | 1.000 | 94.2 | 1.020 | 94.4 |
| 1.040 | 94.0 | 1.060 | 94.4 | 1.080 | 94.4 | 1.100 | 94.5 | 1.120 | 94.5 |
| 1.140 | 94.7 | 1.160 | 94.7 | 1.180 | 94.4 | 1.200 | 94.7 | 1.220 | 94.7 |
| 1.240 | 94.7 | 1.260 | 94.9 | 1.280 | 94.7 | 1.300 | 94.7 | 1.320 | 94.9 |
| 1.340 | 94.8 | 1.360 | 94.8 | 1.380 | 94.7 | 1.400 | 95.1 | 1.420 | 94.9 |
| 1.440 | 94.9 | 1.460 | 94.8 | 1.480 | 94.9 | 1.500 | 95.0 | 1.520 | 95.0 |
| 1.540 | 94.8 | 1.560 | 95.0 | 1.580 | 95.0 | 1.600 | 95.0 | 1.620 | 95.1 |
| 1.640 | 95.2 | 1.660 | 95.2 | 1.680 | 95.3 | 1.700 | 95.1 | 1.720 | 95.1 |
| 1.740 | 95.2 | 1.760 | 95.3 | 1.780 | 95.0 | 1.800 | 95.1 | 1.820 | 95.1 |
| 1.840 | 95.2 | 1.860 | 95.5 | 1.880 | 95.7 | 1.900 | 95.8 | 1.920 | 95.6 |
| 1.940 | 95.9 | 1.960 | 95.6 | 1.980 | 95.7 | 2.000 | 95.8 | 2.020 | 95.7 |
| 2.040 | 95.7 | 2.060 | 95.7 | 2.080 | 95.6 | 2.100 | 95.6 | 2.120 | 95.7 |
| 2.140 | 95.5 | 2.160 | 95.4 | 2.180 | 95.6 | 2.200 | 95.5 | 2.220 | 95.4 |
| 2.240 | 95.5 | 2.260 | 95.9 | 2.280 | 95.9 | 2.300 | 95.9 | 2.320 | 96.0 |
| 2.340 | 96.2 | 2.360 | 96.1 | 2.380 | 96.1 | 2.400 | 96.2 | 2.420 | 96.5 |
| 2.440 | 96.2 | 2.460 | 96.6 | 2.480 | 96.4 | 2.500 | 96.5 | | |

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FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, 8-1 23 AUG 78 470140002

AND ELECTRONS ON THE REFLECTANCE OF SAPPHIRE IN SITU IN SITU, AFTER 50 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.112

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 19.9 | 0.252 | 20.0 | 0.254 | 20.0 | 0.256 | 19.9 | 0.258 | 19.9 |
| 0.260 | 19.6 | 0.262 | 19.5 | 0.264 | 19.6 | 0.266 | 19.4 | 0.268 | 19.1 |
| 0.270 | 19.1 | 0.272 | 18.8 | 0.274 | 18.6 | 0.276 | 18.3 | 0.278 | 17.9 |
| 0.280 | 17.8 | 0.282 | 17.4 | 0.284 | 17.2 | 0.286 | 16.7 | 0.288 | 16.4 |
| 0.290 | 16.0 | 0.292 | 15.4 | 0.294 | 15.2 | 0.296 | 14.6 | 0.298 | 14.1 |
| 0.300 | 13.4 | 0.302 | 12.9 | 0.304 | 12.4 | 0.306 | 12.4 | 0.308 | 12.2 |
| 0.310 | 12.3 | 0.312 | 12.9 | 0.314 | 14.1 | 0.316 | 15.6 | 0.318 | 18.1 |
| 0.320 | 21.9 | 0.322 | 27.1 | 0.324 | 34.0 | 0.326 | 41.0 | 0.328 | 48.7 |
| 0.330 | 54.4 | 0.332 | 59.0 | 0.334 | 62.2 | 0.336 | 64.5 | 0.338 | 65.9 |
| 0.340 | 67.5 | 0.342 | 67.7 | 0.344 | 69.0 | 0.346 | 69.7 | 0.348 | 70.1 |
| 0.350 | 70.3 | 0.352 | 71.7 | 0.354 | 71.8 | 0.356 | 72.4 | 0.358 | 72.3 |
| 0.360 | 72.2 | 0.365 | 73.0 | 0.370 | 73.7 | 0.375 | 74.3 | 0.380 | 75.6 |
| 0.385 | 76.6 | 0.390 | 77.2 | 0.395 | 78.1 | 0.400 | 79.1 | 0.405 | 80.1 |
| 0.410 | 81.2 | 0.415 | 81.7 | 0.420 | 82.4 | 0.425 | 83.0 | 0.430 | 84.0 |
| 0.435 | 84.5 | 0.440 | 85.2 | 0.445 | 85.1 | 0.450 | 85.9 | 0.455 | 86.5 |
| 0.460 | 86.5 | 0.465 | 87.0 | 0.470 | 86.9 | 0.475 | 87.1 | 0.480 | 87.8 |
| 0.485 | 87.9 | 0.490 | 88.0 | 0.495 | 88.4 | 0.500 | 88.3 | 0.505 | 89.2 |
| 0.510 | 88.8 | 0.515 | 89.2 | 0.520 | 89.3 | 0.525 | 89.5 | 0.530 | 89.8 |
| 0.535 | 90.0 | 0.540 | 90.3 | 0.545 | 90.4 | 0.550 | 90.5 | 0.555 | 90.8 |
| 0.560 | 90.8 | 0.565 | 91.3 | 0.570 | 91.6 | 0.575 | 91.5 | 0.580 | 91.7 |
| 0.585 | 91.9 | 0.590 | 91.9 | 0.595 | 92.1 | 0.600 | 92.2 | 0.605 | 92.0 |
| 0.610 | 92.3 | 0.615 | 92.2 | 0.620 | 92.4 | 0.625 | 92.3 | 0.630 | 92.6 |
| 0.635 | 92.2 | 0.640 | 92.4 | 0.645 | 92.4 | 0.650 | 92.7 | 0.655 | 92.4 |
| 0.660 | 92.6 | 0.665 | 92.3 | 0.670 | 92.3 | 0.675 | 92.6 | 0.680 | 92.6 |
| 0.685 | 92.7 | 0.690 | 92.5 | 0.695 | 92.6 | 0.700 | 92.5 | 0.720 | 93.3 |
| 0.740 | 93.2 | 0.760 | 93.4 | 0.780 | 93.8 | 0.800 | 93.5 | 0.820 | 93.5 |
| 0.840 | 93.4 | 0.860 | 93.7 | 0.880 | 93.8 | 0.900 | 94.0 | 0.920 | 94.2 |
| 0.940 | 93.9 | 0.960 | 94.3 | 0.980 | 94.3 | 1.000 | 94.2 | 1.020 | 94.5 |
| 1.040 | 94.2 | 1.060 | 94.4 | 1.080 | 94.4 | 1.100 | 94.6 | 1.120 | 94.6 |
| 1.140 | 94.4 | 1.160 | 94.5 | 1.180 | 94.5 | 1.200 | 94.7 | 1.220 | 94.8 |
| 1.240 | 94.8 | 1.260 | 94.6 | 1.280 | 94.7 | 1.300 | 95.0 | 1.320 | 94.9 |
| 1.340 | 94.8 | 1.360 | 95.0 | 1.380 | 94.7 | 1.400 | 95.2 | 1.420 | 94.9 |
| 1.440 | 94.8 | 1.460 | 94.9 | 1.480 | 94.9 | 1.500 | 95.0 | 1.520 | 95.0 |
| 1.540 | 94.9 | 1.560 | 94.9 | 1.580 | 95.0 | 1.600 | 95.0 | 1.620 | 95.0 |
| 1.640 | 95.1 | 1.660 | 95.1 | 1.680 | 95.2 | 1.700 | 95.1 | 1.720 | 95.0 |
| 1.740 | 95.3 | 1.760 | 95.1 | 1.780 | 95.0 | 1.800 | 95.0 | 1.820 | 95.0 |
| 1.840 | 95.2 | 1.860 | 95.4 | 1.880 | 95.3 | 1.900 | 95.7 | 1.920 | 95.5 |
| 1.940 | 95.9 | 1.960 | 95.7 | 1.980 | 95.6 | 2.000 | 95.8 | 2.020 | 95.4 |
| 2.040 | 95.4 | 2.060 | 95.7 | 2.080 | 95.6 | 2.100 | 95.5 | 2.120 | 95.6 |
| 2.140 | 95.4 | 2.160 | 95.5 | 2.180 | 95.3 | 2.200 | 95.3 | 2.220 | 95.8 |
| 2.240 | 95.6 | 2.260 | 95.8 | 2.280 | 95.8 | 2.300 | 95.8 | 2.320 | 95.8 |
| 2.340 | 95.8 | 2.360 | 95.9 | 2.380 | 95.9 | 2.400 | 95.9 | 2.420 | 96.1 |
| 2.440 | 96.0 | 2.460 | 96.4 | 2.480 | 96.1 | 2.500 | 96.3 | | |

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, S-1 23 AUG 78 470140003

AND ELECTRONS ON THE REFLECTANCE OF SAPPHIRE IN SITU IN SITU, AFTER 154 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0,110

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0,230 | 0,0 | 0,232 | 0,0 | 0,234 | 0,0 | 0,236 | 0,0 | 0,238 | 0,0 |
| 0,240 | 0,0 | 0,242 | 0,0 | 0,244 | 0,0 | 0,246 | 0,0 | 0,248 | 0,0 |
| 0,250 | 20,0 | 0,252 | 20,1 | 0,254 | 20,1 | 0,256 | 20,1 | 0,258 | 19,8 |
| 0,260 | 19,8 | 0,262 | 19,5 | 0,264 | 19,5 | 0,266 | 19,4 | 0,268 | 19,2 |
| 0,270 | 19,0 | 0,272 | 18,9 | 0,274 | 18,6 | 0,276 | 18,4 | 0,278 | 18,4 |
| 0,280 | 17,9 | 0,282 | 17,6 | 0,284 | 17,2 | 0,286 | 17,0 | 0,288 | 16,7 |
| 0,290 | 16,3 | 0,292 | 15,9 | 0,294 | 15,5 | 0,296 | 15,0 | 0,298 | 14,3 |
| 0,300 | 13,7 | 0,302 | 13,3 | 0,304 | 12,9 | 0,306 | 12,6 | 0,308 | 12,5 |
| 0,310 | 17,9 | 0,312 | 13,3 | 0,314 | 14,7 | 0,316 | 16,3 | 0,318 | 18,8 |
| 0,320 | 22,6 | 0,322 | 28,0 | 0,324 | 34,8 | 0,326 | 42,1 | 0,328 | 48,8 |
| 0,330 | 55,1 | 0,332 | 58,6 | 0,334 | 61,5 | 0,336 | 63,6 | 0,338 | 65,4 |
| 0,340 | 66,6 | 0,342 | 67,9 | 0,344 | 68,1 | 0,346 | 68,4 | 0,348 | 69,9 |
| 0,350 | 70,0 | 0,352 | 70,3 | 0,354 | 70,9 | 0,356 | 71,0 | 0,358 | 72,2 |
| 0,360 | 72,0 | 0,365 | 72,8 | 0,370 | 73,9 | 0,375 | 74,6 | 0,380 | 75,7 |
| 0,385 | 76,6 | 0,390 | 77,6 | 0,395 | 78,8 | 0,400 | 79,4 | 0,405 | 80,2 |
| 0,410 | 81,3 | 0,415 | 82,0 | 0,420 | 82,7 | 0,425 | 83,2 | 0,430 | 84,1 |
| 0,435 | 84,6 | 0,440 | 85,6 | 0,445 | 85,4 | 0,450 | 86,2 | 0,455 | 86,9 |
| 0,460 | 87,0 | 0,465 | 87,2 | 0,470 | 87,6 | 0,475 | 87,7 | 0,480 | 88,1 |
| 0,485 | 88,2 | 0,490 | 88,5 | 0,495 | 89,0 | 0,500 | 88,9 | 0,505 | 89,2 |
| 0,510 | 89,0 | 0,515 | 89,8 | 0,520 | 89,6 | 0,525 | 90,0 | 0,530 | 90,4 |
| 0,535 | 90,2 | 0,540 | 90,7 | 0,545 | 91,0 | 0,550 | 91,2 | 0,555 | 90,9 |
| 0,560 | 91,2 | 0,565 | 91,7 | 0,570 | 91,6 | 0,575 | 91,7 | 0,580 | 91,8 |
| 0,585 | 92,5 | 0,590 | 92,7 | 0,595 | 92,3 | 0,600 | 92,8 | 0,605 | 92,6 |
| 0,610 | 93,0 | 0,615 | 92,5 | 0,620 | 92,7 | 0,625 | 93,2 | 0,630 | 93,1 |
| 0,635 | 93,0 | 0,640 | 93,1 | 0,645 | 92,7 | 0,650 | 92,7 | 0,655 | 92,6 |
| 0,660 | 92,6 | 0,665 | 92,7 | 0,670 | 92,9 | 0,675 | 93,0 | 0,680 | 92,9 |
| 0,685 | 92,9 | 0,690 | 92,7 | 0,695 | 93,1 | 0,700 | 93,0 | 0,720 | 93,0 |
| 0,740 | 92,9 | 0,760 | 93,2 | 0,780 | 93,3 | 0,800 | 93,2 | 0,820 | 93,4 |
| 0,840 | 93,5 | 0,860 | 93,8 | 0,880 | 94,0 | 0,900 | 94,0 | 0,920 | 94,2 |
| 0,940 | 93,9 | 0,960 | 94,2 | 0,980 | 94,4 | 1,000 | 94,2 | 1,020 | 94,6 |
| 1,040 | 94,2 | 1,060 | 94,4 | 1,080 | 94,5 | 1,100 | 94,8 | 1,120 | 94,6 |
| 1,140 | 94,5 | 1,160 | 94,7 | 1,180 | 94,6 | 1,200 | 94,8 | 1,220 | 94,9 |
| 1,240 | 94,8 | 1,260 | 94,9 | 1,280 | 94,8 | 1,300 | 95,1 | 1,320 | 95,1 |
| 1,340 | 94,9 | 1,360 | 95,0 | 1,380 | 94,9 | 1,400 | 95,3 | 1,420 | 95,2 |
| 1,440 | 95,0 | 1,460 | 95,1 | 1,480 | 95,0 | 1,500 | 95,2 | 1,520 | 95,2 |
| 1,540 | 95,1 | 1,560 | 95,1 | 1,580 | 95,3 | 1,600 | 95,2 | 1,620 | 95,3 |
| 1,640 | 95,4 | 1,660 | 95,3 | 1,680 | 95,3 | 1,700 | 95,3 | 1,720 | 95,2 |
| 1,740 | 95,4 | 1,760 | 95,4 | 1,780 | 95,3 | 1,800 | 95,3 | 1,820 | 95,3 |
| 1,840 | 95,4 | 1,860 | 95,5 | 1,880 | 95,5 | 1,900 | 95,9 | 1,920 | 95,8 |
| 1,940 | 95,8 | 1,960 | 95,9 | 1,980 | 95,8 | 2,000 | 95,8 | 2,020 | 95,8 |
| 2,040 | 95,8 | 2,060 | 95,9 | 2,080 | 95,8 | 2,100 | 95,8 | 2,120 | 95,9 |
| 2,140 | 95,7 | 2,160 | 95,5 | 2,180 | 95,6 | 2,200 | 95,7 | 2,220 | 95,4 |
| 2,240 | 95,7 | 2,260 | 96,0 | 2,280 | 95,9 | 2,300 | 96,2 | 2,320 | 96,2 |
| 2,340 | 96,0 | 2,360 | 96,1 | 2,380 | 96,1 | 2,400 | 96,2 | 2,420 | 96,2 |
| 2,440 | 96,2 | 2,460 | 96,7 | 2,480 | 96,4 | 2,500 | 96,5 | | |

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, S-1 23 AUG 78 470140004

AND ELECTRONS ON THE REFLECTANCE OF SAPPHIRE IN SITU IN SITU, AFTER 313 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.115

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 19.7 | 0.252 | 19.6 | 0.254 | 19.7 | 0.256 | 19.4 | 0.258 | 19.4 |
| 0.260 | 19.3 | 0.262 | 19.3 | 0.264 | 19.2 | 0.266 | 19.1 | 0.268 | 19.1 |
| 0.270 | 18.7 | 0.272 | 18.6 | 0.274 | 18.2 | 0.276 | 18.2 | 0.278 | 18.0 |
| 0.280 | 17.5 | 0.282 | 17.3 | 0.284 | 16.9 | 0.286 | 16.8 | 0.288 | 16.4 |
| 0.290 | 16.0 | 0.292 | 15.6 | 0.294 | 15.2 | 0.296 | 14.6 | 0.298 | 14.2 |
| 0.300 | 13.6 | 0.302 | 13.2 | 0.304 | 12.8 | 0.306 | 12.5 | 0.308 | 12.6 |
| 0.310 | 12.8 | 0.312 | 13.6 | 0.314 | 14.2 | 0.316 | 16.2 | 0.318 | 18.6 |
| 0.320 | 21.9 | 0.322 | 28.0 | 0.324 | 33.8 | 0.326 | 41.0 | 0.328 | 47.2 |
| 0.330 | 53.3 | 0.332 | 57.4 | 0.334 | 60.3 | 0.336 | 62.2 | 0.338 | 63.6 |
| 0.340 | 65.2 | 0.342 | 66.1 | 0.344 | 67.0 | 0.346 | 67.3 | 0.348 | 68.5 |
| 0.350 | 68.5 | 0.352 | 68.9 | 0.354 | 69.2 | 0.356 | 69.5 | 0.358 | 70.0 |
| 0.360 | 70.2 | 0.365 | 71.1 | 0.370 | 71.8 | 0.375 | 72.8 | 0.380 | 73.9 |
| 0.385 | 75.0 | 0.390 | 75.9 | 0.395 | 76.9 | 0.400 | 77.8 | 0.405 | 78.8 |
| 0.410 | 79.9 | 0.415 | 80.4 | 0.420 | 81.7 | 0.425 | 82.1 | 0.430 | 82.9 |
| 0.435 | 83.6 | 0.440 | 84.2 | 0.445 | 84.2 | 0.450 | 85.2 | 0.455 | 85.7 |
| 0.460 | 86.1 | 0.465 | 86.3 | 0.470 | 86.5 | 0.475 | 86.6 | 0.480 | 87.1 |
| 0.465 | 87.3 | 0.490 | 87.5 | 0.495 | 87.8 | 0.500 | 88.0 | 0.505 | 88.4 |
| 0.510 | 88.5 | 0.515 | 88.7 | 0.520 | 88.8 | 0.525 | 89.1 | 0.530 | 89.6 |
| 0.535 | 89.7 | 0.540 | 90.4 | 0.545 | 90.4 | 0.550 | 90.3 | 0.555 | 90.4 |
| 0.560 | 90.6 | 0.565 | 91.0 | 0.570 | 91.0 | 0.575 | 91.5 | 0.580 | 91.2 |
| 0.585 | 92.1 | 0.590 | 91.9 | 0.595 | 92.0 | 0.600 | 92.5 | 0.605 | 92.2 |
| 0.610 | 92.3 | 0.615 | 92.3 | 0.620 | 92.3 | 0.625 | 92.6 | 0.630 | 92.4 |
| 0.635 | 92.1 | 0.640 | 92.5 | 0.645 | 92.1 | 0.650 | 92.3 | 0.655 | 92.3 |
| 0.660 | 92.6 | 0.665 | 92.3 | 0.670 | 92.5 | 0.675 | 92.6 | 0.680 | 92.5 |
| 0.685 | 92.4 | 0.690 | 92.4 | 0.695 | 92.7 | 0.700 | 92.5 | 0.720 | 93.0 |
| 0.740 | 93.1 | 0.760 | 93.1 | 0.780 | 93.5 | 0.800 | 93.3 | 0.820 | 93.4 |
| 0.840 | 93.4 | 0.860 | 93.7 | 0.880 | 93.9 | 0.900 | 94.0 | 0.920 | 94.1 |
| 0.940 | 94.0 | 0.960 | 94.2 | 0.980 | 94.5 | 1.000 | 94.2 | 1.020 | 94.5 |
| 1.040 | 94.1 | 1.060 | 94.4 | 1.080 | 94.5 | 1.100 | 94.8 | 1.120 | 94.6 |
| 1.140 | 94.7 | 1.160 | 94.6 | 1.180 | 94.8 | 1.200 | 94.6 | 1.220 | 94.8 |
| 1.240 | 94.8 | 1.260 | 95.0 | 1.280 | 94.8 | 1.300 | 95.2 | 1.320 | 95.0 |
| 1.340 | 94.9 | 1.360 | 94.9 | 1.380 | 94.8 | 1.400 | 95.2 | 1.420 | 95.1 |
| 1.440 | 95.1 | 1.460 | 95.1 | 1.480 | 95.2 | 1.500 | 95.1 | 1.520 | 95.2 |
| 1.540 | 95.0 | 1.560 | 95.0 | 1.580 | 95.2 | 1.600 | 95.1 | 1.620 | 95.2 |
| 1.640 | 95.3 | 1.660 | 95.3 | 1.680 | 95.3 | 1.700 | 95.2 | 1.720 | 95.2 |
| 1.740 | 95.3 | 1.760 | 95.5 | 1.780 | 95.3 | 1.800 | 95.5 | 1.820 | 95.5 |
| 1.840 | 95.6 | 1.860 | 95.7 | 1.880 | 95.6 | 1.900 | 95.8 | 1.920 | 95.7 |
| 1.940 | 95.9 | 1.960 | 95.8 | 1.980 | 95.9 | 2.000 | 96.0 | 2.020 | 95.9 |
| 2.040 | 95.9 | 2.060 | 95.8 | 2.080 | 95.6 | 2.100 | 95.6 | 2.120 | 95.8 |
| 2.140 | 95.6 | 2.160 | 95.6 | 2.180 | 95.6 | 2.200 | 95.6 | 2.220 | 95.6 |
| 2.240 | 95.8 | 2.260 | 96.0 | 2.280 | 95.9 | 2.300 | 95.8 | 2.320 | 95.9 |
| 2.340 | 96.1 | 2.360 | 96.3 | 2.380 | 96.2 | 2.400 | 96.2 | 2.420 | 96.4 |
| 2.440 | 75.8 | 2.460 | 96.5 | 2.480 | 96.3 | 2.500 | 96.5 | | |

FIGURE , EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, S-1 23 AUG 78 470140005

AND ELECTRONS ON THE REFLECTANCE OF SAPPHIRE IN SITU IN SITU, AFTER 503 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.118

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 19.3 | 0.252 | 19.0 | 0.254 | 19.2 | 0.256 | 19.2 | 0.258 | 19.1 |
| 0.260 | 19.1 | 0.262 | 19.0 | 0.264 | 18.9 | 0.266 | 18.7 | 0.268 | 18.6 |
| 0.270 | 18.4 | 0.272 | 18.3 | 0.274 | 18.1 | 0.276 | 17.9 | 0.278 | 17.7 |
| 0.280 | 17.5 | 0.282 | 17.3 | 0.284 | 17.0 | 0.286 | 16.8 | 0.288 | 16.3 |
| 0.290 | 15.9 | 0.292 | 15.8 | 0.294 | 15.1 | 0.296 | 14.7 | 0.298 | 14.2 |
| 0.300 | 14.0 | 0.302 | 13.6 | 0.304 | 12.6 | 0.306 | 12.5 | 0.308 | 12.6 |
| 0.310 | 12.9 | 0.312 | 13.5 | 0.314 | 14.6 | 0.316 | 15.9 | 0.318 | 18.3 |
| 0.320 | 22.0 | 0.322 | 26.7 | 0.324 | 33.1 | 0.326 | 40.0 | 0.328 | 46.0 |
| 0.330 | 51.5 | 0.332 | 55.2 | 0.334 | 58.4 | 0.336 | 59.9 | 0.338 | 61.9 |
| 0.340 | 62.9 | 0.342 | 64.0 | 0.344 | 65.2 | 0.346 | 65.2 | 0.348 | 66.2 |
| 0.350 | 66.2 | 0.352 | 67.7 | 0.354 | 67.6 | 0.356 | 67.6 | 0.358 | 68.0 |
| 0.360 | 68.6 | 0.365 | 69.8 | 0.370 | 70.6 | 0.375 | 71.4 | 0.380 | 72.7 |
| 0.385 | 73.6 | 0.390 | 74.7 | 0.395 | 75.8 | 0.400 | 76.5 | 0.405 | 77.8 |
| 0.410 | 78.6 | 0.415 | 79.5 | 0.420 | 80.3 | 0.425 | 80.8 | 0.430 | 82.2 |
| 0.435 | 82.3 | 0.440 | 83.3 | 0.445 | 83.7 | 0.450 | 84.6 | 0.455 | 84.9 |
| 0.460 | 85.4 | 0.465 | 85.3 | 0.470 | 85.9 | 0.475 | 86.1 | 0.480 | 86.5 |
| 0.485 | 86.9 | 0.490 | 86.8 | 0.495 | 87.4 | 0.500 | 87.3 | 0.505 | 88.2 |
| 0.510 | 88.1 | 0.515 | 88.4 | 0.520 | 88.5 | 0.525 | 88.9 | 0.530 | 89.3 |
| 0.535 | 89.1 | 0.540 | 89.8 | 0.545 | 90.1 | 0.550 | 90.1 | 0.555 | 90.1 |
| 0.560 | 90.5 | 0.565 | 90.8 | 0.570 | 91.1 | 0.575 | 91.3 | 0.580 | 91.5 |
| 0.585 | 92.0 | 0.590 | 92.3 | 0.595 | 91.7 | 0.600 | 92.4 | 0.605 | 91.8 |
| 0.610 | 92.3 | 0.615 | 91.9 | 0.620 | 92.4 | 0.625 | 92.3 | 0.630 | 92.1 |
| 0.635 | 92.5 | 0.640 | 92.3 | 0.645 | 92.1 | 0.650 | 92.1 | 0.655 | 92.6 |
| 0.660 | 92.3 | 0.665 | 91.9 | 0.670 | 92.2 | 0.675 | 92.8 | [illegible] | 92.5 |
| 0.685 | 92.5 | 0.690 | 92.3 | 0.695 | 92.4 | 0.700 | 92.5 | 0.720 | 92.7 |
| 0.740 | 92.7 | 0.760 | 92.8 | 0.780 | 93.0 | 0.800 | 93.2 | 0.820 | 93.3 |
| 0.840 | 93.5 | 0.860 | 93.6 | 0.880 | 93.8 | 0.900 | 94.0 | 0.920 | 93.8 |
| 0.940 | 93.7 | 0.960 | 94.3 | 0.980 | 94.3 | 1.000 | 94.2 | 1.020 | 94.4 |
| 1.040 | 94.1 | 1.060 | 94.4 | 1.080 | 94.4 | 1.100 | 94.5 | 1.120 | 94.8 |
| 1.140 | 94.4 | 1.160 | 94.6 | 1.180 | 94.5 | 1.200 | 94.6 | 1.220 | 94.8 |
| 1.240 | 94.8 | 1.260 | 94.8 | 1.280 | 94.8 | 1.300 | 94.8 | 1.320 | 94.8 |
| 1.340 | 94.8 | 1.360 | 94.9 | 1.380 | 94.7 | 1.400 | 95.1 | 1.420 | 94.9 |
| 1.440 | 94.9 | 1.460 | 94.9 | 1.480 | 94.9 | 1.500 | 95.1 | 1.520 | 95.0 |
| 1.540 | 95.0 | 1.560 | 95.0 | 1.580 | 95.2 | 1.600 | 95.0 | 1.620 | 95.2 |
| 1.640 | 95.2 | 1.660 | 95.2 | 1.680 | 95.2 | 1.700 | 95.0 | 1.720 | 95.1 |
| 1.740 | 95.3 | 1.760 | 95.3 | 1.780 | 95.2 | 1.800 | 95.2 | 1.820 | 95.1 |
| 1.840 | 95.2 | 1.860 | 95.4 | 1.880 | 95.4 | 1.900 | 95.5 | 1.920 | 95.5 |
| 1.940 | 95.6 | 1.960 | 95.5 | 1.980 | 95.7 | 2.000 | 95.7 | 2.020 | 95.6 |
| 2.040 | 95.6 | 2.060 | 95.6 | 2.080 | 95.6 | 2.100 | 95.6 | 2.120 | 95.6 |
| 2.140 | 95.4 | 2.160 | 95.4 | 2.180 | 95.3 | 2.200 | 95.5 | 2.220 | 95.2 |
| 2.240 | 95.5 | 2.260 | 95.7 | 2.280 | 95.7 | 2.300 | 95.8 | 2.320 | 95.8 |
| 2.340 | 95.8 | 2.360 | 95.8 | 2.380 | 95.8 | 2.400 | 95.9 | 2.420 | 95.9 |
| 2.440 | 95.7 | 2.460 | 96.2 | 2.480 | 96.0 | 2.500 | 96.0 | | |

FIGURE . EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON 71-1 23 AUG 78 710180001

THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU IN VACUUM, BEFORE EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.085

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 6.1 | 0.252 | 6.2 | 0.254 | 6.1 | 0.256 | 6.1 | 0.258 | 5.9 |
| 0.260 | 5.9 | 0.262 | 6.0 | 0.264 | 6.0 | 0.266 | 5.8 | 0.268 | 5.8 |
| 0.270 | 5.8 | 0.272 | 5.7 | 0.274 | 5.7 | 0.276 | 5.6 | 0.278 | 5.7 |
| 0.280 | 5.9 | 0.282 | 6.2 | 0.284 | 7.0 | 0.286 | 7.8 | 0.288 | 8.6 |
| 0.290 | 9.5 | 0.292 | 10.0 | 0.294 | 10.5 | 0.296 | 10.5 | 0.298 | 10.7 |
| 0.300 | 10.5 | 0.302 | 9.8 | 0.304 | 9.2 | 0.306 | 8.9 | 0.308 | 8.6 |
| 0.310 | 8.3 | 0.312 | 8.5 | 0.314 | 9.5 | 0.316 | 10.9 | 0.318 | 13.3 |
| 0.320 | 16.6 | 0.322 | 22.5 | 0.324 | 30.1 | 0.326 | 38.9 | 0.328 | 48.2 |
| 0.330 | 55.7 | 0.332 | 62.0 | 0.334 | 66.4 | 0.336 | 69.2 | 0.338 | 72.4 |
| 0.340 | 74.2 | 0.342 | 75.9 | 0.344 | 77.3 | 0.346 | 79.3 | 0.348 | 79.7 |
| 0.350 | 80.9 | 0.352 | 81.7 | 0.354 | 81.8 | 0.356 | 83.0 | 0.358 | 84.4 |
| 0.360 | 84.7 | 0.365 | 86.1 | 0.370 | 87.2 | 0.375 | 88.3 | 0.380 | 89.0 |
| 0.385 | 90.3 | 0.390 | 90.9 | 0.395 | 91.4 | 0.400 | 91.7 | 0.405 | 91.8 |
| 0.410 | 92.3 | 0.415 | 92.7 | 0.420 | 93.0 | 0.425 | 93.2 | 0.430 | 93.8 |
| 0.435 | 93.8 | 0.440 | 94.2 | 0.445 | 93.7 | 0.450 | 94.1 | 0.455 | 94.1 |
| 0.460 | 94.3 | 0.465 | 94.3 | 0.470 | 94.3 | 0.475 | 93.9 | 0.480 | 94.4 |
| 0.485 | 94.0 | 0.490 | 94.5 | 0.495 | 94.3 | 0.500 | 94.2 | 0.505 | 94.6 |
| 0.510 | 94.3 | 0.515 | 94.5 | 0.520 | 94.5 | 0.525 | 94.5 | 0.530 | 94.8 |
| 0.535 | 95.0 | 0.540 | 95.1 | 0.545 | 94.9 | 0.550 | 94.6 | 0.555 | 95.1 |
| 0.560 | 95.0 | 0.565 | 95.5 | 0.570 | 95.5 | 0.575 | 95.4 | 0.580 | 95.5 |
| 0.585 | 95.9 | 0.590 | 95.8 | 0.595 | 95.4 | 0.600 | 95.7 | 0.605 | 95.5 |
| 0.610 | 95.6 | 0.615 | 95.6 | 0.620 | 95.6 | 0.625 | 95.7 | 0.630 | 95.7 |
| 0.635 | 95.8 | 0.640 | 95.5 | 0.645 | 95.8 | 0.650 | 95.6 | 0.655 | 95.4 |
| 0.660 | 95.5 | 0.665 | 95.4 | 0.670 | 95.4 | 0.675 | 95.6 | 0.680 | 95.5 |
| 0.685 | 95.5 | 0.690 | 95.4 | 0.695 | 95.4 | 0.700 | 95.4 | 0.720 | 95.0 |
| 0.740 | 95.2 | 0.760 | 95.1 | 0.780 | 95.1 | 0.800 | 95.2 | 0.820 | 95.1 |
| 0.840 | 95.0 | 0.860 | 95.4 | 0.880 | 95.5 | 0.900 | 95.5 | 0.920 | 95.5 |
| 0.940 | 95.3 | 0.960 | 95.7 | 0.980 | 95.7 | 1.000 | 95.6 | 1.020 | 95.7 |
| 1.040 | 95.3 | 1.060 | 95.7 | 1.080 | 95.7 | 1.100 | 95.8 | 1.120 | 95.7 |
| 1.140 | 95.6 | 1.160 | 95.8 | 1.180 | 95.5 | 1.200 | 95.7 | 1.220 | 95.7 |
| 1.240 | 95.8 | 1.260 | 95.9 | 1.280 | 95.7 | 1.300 | 95.5 | 1.320 | 94.9 |
| 1.340 | 93.3 | 1.360 | 92.7 | 1.380 | 93.7 | 1.400 | 95.3 | 1.420 | 95.8 |
| 1.440 | 95.9 | 1.460 | 95.8 | 1.480 | 95.9 | 1.500 | 96.1 | 1.520 | 96.0 |
| 1.540 | 95.9 | 1.560 | 96.0 | 1.580 | 96.1 | 1.600 | 96.0 | 1.620 | 96.1 |
| 1.640 | 96.2 | 1.660 | 96.2 | 1.680 | 96.2 | 1.700 | 96.0 | 1.720 | 96.0 |
| 1.740 | 96.1 | 1.760 | 96.2 | 1.780 | 96.0 | 1.800 | 96.0 | 1.820 | 95.9 |
| 1.840 | 96.0 | 1.860 | 96.2 | 1.880 | 96.3 | 1.900 | 96.4 | 1.920 | 96.2 |
| 1.940 | 96.5 | 1.960 | 96.3 | 1.980 | 96.3 | 2.000 | 96.3 | 2.020 | 95.8 |
| 2.040 | 95.7 | 2.060 | 95.6 | 2.080 | 95.3 | 2.100 | 94.9 | 2.120 | 94.2 |
| 2.140 | 92.1 | 2.160 | 88.7 | 2.180 | 84.9 | 2.200 | 81.7 | 2.220 | 81.0 |
| 2.240 | 92.8 | 2.260 | 86.2 | 2.280 | 89.0 | 2.300 | 91.2 | 2.320 | 92.8 |
| 2.340 | 93.3 | 2.360 | 93.2 | 2.380 | 93.0 | 2.400 | 92.2 | 2.420 | 91.4 |
| 2.440 | 89.8 | 2.460 | 88.7 | 2.480 | 86.7 | 2.500 | 84.7 | | |

FIGURE , EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON 71-1 23 AUG 78 710140002

THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU IN SITU, AFTER 50 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.092

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 6.0 | 0.252 | 6.1 | 0.254 | 6.1 | 0.256 | 6.1 | 0.258 | 6.0 |
| 0.260 | 6.1 | 0.262 | 5.9 | 0.264 | 5.8 | 0.266 | 5.8 | 0.268 | 5.7 |
| 0.270 | 5.7 | 0.272 | 5.8 | 0.274 | 5.6 | 0.276 | 5.6 | 0.278 | 5.8 |
| 0.280 | 6.0 | 0.282 | 6.4 | 0.284 | 7.0 | 0.286 | 7.7 | 0.288 | 8.6 |
| 0.290 | 9.3 | 0.292 | 9.7 | 0.294 | 10.2 | 0.296 | 10.6 | 0.298 | 10.7 |
| 0.300 | 10.3 | 0.302 | 9.9 | 0.304 | 9.2 | 0.306 | 8.8 | 0.308 | 8.3 |
| 0.310 | 8.0 | 0.312 | 8.4 | 0.314 | 9.2 | 0.316 | 10.9 | 0.318 | 13.1 |
| 0.320 | 16.3 | 0.322 | 22.0 | 0.324 | 29.6 | 0.326 | 38.4 | 0.328 | 47.2 |
| 0.330 | 54.8 | 0.332 | 61.3 | 0.334 | 65.5 | 0.336 | 69.0 | 0.338 | 71.4 |
| 0.340 | 73.6 | 0.342 | 74.9 | 0.344 | 76.6 | 0.346 | 77.5 | 0.348 | 78.8 |
| 0.350 | 79.5 | 0.352 | 80.7 | 0.354 | 81.1 | 0.356 | 82.3 | 0.358 | 82.9 |
| 0.360 | 83.0 | 0.365 | 84.4 | 0.370 | 85.4 | 0.375 | 86.1 | 0.380 | 87.4 |
| 0.385 | 88.3 | 0.390 | 88.6 | 0.395 | 89.0 | 0.400 | 89.5 | 0.405 | 90.0 |
| 0.410 | 90.5 | 0.415 | 90.7 | 0.420 | 91.2 | 0.425 | 91.6 | 0.430 | 92.0 |
| 0.435 | 92.1 | 0.440 | 92.3 | 0.445 | 92.2 | 0.450 | 92.4 | 0.455 | 92.8 |
| 0.460 | 92.7 | 0.465 | 92.7 | 0.470 | 92.1 | 0.475 | 92.2 | 0.480 | 93.0 |
| 0.485 | 92.6 | 0.490 | 92.8 | 0.495 | 93.0 | 0.500 | 92.8 | 0.505 | 93.3 |
| 0.510 | 93.1 | 0.515 | 93.2 | 0.520 | 93.0 | 0.525 | 93.3 | 0.530 | 93.5 |
| 0.535 | 93.6 | 0.540 | 93.7 | 0.545 | 93.7 | 0.550 | 93.8 | 0.555 | 94.1 |
| 0.560 | 94.0 | 0.565 | 94.7 | 0.570 | 94.6 | 0.575 | 94.2 | 0.580 | 94.4 |
| 0.595 | 94.7 | 0.590 | 94.6 | 0.595 | 94.4 | 0.600 | 94.9 | 0.605 | 94.6 |
| 0.610 | 94.8 | 0.615 | 94.4 | 0.620 | 95.0 | 0.625 | 94.9 | 0.630 | 94.7 |
| 0.635 | 94.6 | 0.640 | 94.4 | 0.645 | 94.5 | 0.650 | 94.9 | 0.655 | 94.7 |
| 0.660 | 94.7 | 0.665 | 94.5 | 0.670 | 94.3 | 0.675 | 94.7 | 0.680 | 94.7 |
| 0.685 | 94.8 | 0.690 | 94.7 | 0.695 | 94.7 | 0.700 | 94.8 | 0.720 | 94.8 |
| 0.740 | 94.9 | 0.760 | 94.7 | 0.780 | 95.0 | 0.800 | 94.9 | 0.820 | 94.9 |
| 0.840 | 94.8 | 0.860 | 95.1 | 0.860 | 95.2 | 0.900 | 95.4 | 0.920 | 95.5 |
| 0.940 | 95.2 | 0.960 | 95.6 | 0.980 | 95.6 | 1.000 | 95.4 | 1.020 | 95.6 |
| 1.040 | 95.5 | 1.060 | 95.7 | 1.080 | 95.5 | 1.100 | 95.9 | 1.120 | 95.7 |
| 1.140 | 95.5 | 1.160 | 95.6 | 1.180 | 95.6 | 1.200 | 95.6 | 1.220 | 95.8 |
| 1.240 | 95.8 | 1.260 | 95.6 | 1.280 | 95.5 | 1.300 | 95.5 | 1.320 | 94.5 |
| 1.340 | 93.1 | 1.360 | 92.8 | 1.380 | 93.7 | 1.400 | 95.2 | 1.420 | 95.6 |
| 1.440 | 95.6 | 1.460 | 95.8 | 1.480 | 95.8 | 1.500 | 96.0 | 1.520 | 95.9 |
| 1.540 | 95.8 | 1.560 | 95.9 | 1.580 | 96.1 | 1.600 | 95.9 | 1.620 | 96.0 |
| 1.640 | 96.1 | 1.660 | 96.0 | 1.680 | 96.1 | 1.700 | 96.0 | 1.720 | 95.[illegible] |
| 1.740 | 96.2 | 1.760 | 96.0 | 1.780 | 95.8 | 1.800 | 95.8 | 1.820 | 95.9 |
| 1.840 | 95.9 | 1.860 | 96.1 | 1.880 | 96.0 | 1.900 | 96.2 | 1.920 | 96.2 |
| 1.940 | 96.3 | 1.960 | 96.2 | 1.980 | 96.1 | 2.000 | 96.0 | 2.020 | 95.5 |
| 2.040 | 95.5 | 2.060 | 95.5 | 2.080 | 95.2 | 2.100 | 94.9 | 2.120 | 94.1 |
| 2.140 | 92.2 | 2.160 | 87.0 | 2.180 | 84.6 | 2.200 | 81.4 | 2.220 | 81.0 |
| 2.240 | 82.9 | 2.260 | 86.0 | 2.280 | 88.8 | 2.300 | 91.0 | 2.320 | 92.5 |
| 2.340 | 93.1 | 2.360 | 93.2 | 2.380 | 92.9 | 2.400 | 91.9 | 2.420 | 91.1 |
| 2.440 | 89.7 | 2.460 | 88.5 | 2.480 | 86.5 | 2.500 | 84.6 | | |

FIGURE . EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON 71-1 23 AUG 78 710:40003

THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU IN SITU. AFTER 154 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.094

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 6.5 | 0.252 | 6.7 | 0.254 | 6.8 | 0.256 | 6.7 | 0.258 | 6.6 |
| 0.260 | 6.6 | 0.262 | 6.5 | 0.264 | 6.5 | 0.266 | 6.3 | 0.268 | 6.3 |
| 0.270 | 6.3 | 0.272 | 6.3 | 0.274 | 6.2 | 0.276 | 6.3 | 0.278 | 6.3 |
| 0.280 | 6.6 | 0.282 | 7.0 | 0.284 | 7.7 | 0.286 | 8.3 | 0.288 | 9.2 |
| 0.290 | 9.7 | 0.292 | 10.4 | 0.294 | 10.8 | 0.296 | 11.0 | 0.298 | 10.8 |
| 0.300 | 10.7 | 0.302 | 10.2 | 0.304 | 9.7 | 0.306 | 9.2 | 0.308 | 8.8 |
| 0.310 | 8.8 | 0.312 | 8.9 | 0.314 | 9.9 | 0.316 | 11.5 | 0.318 | 13.6 |
| 0.320 | 16.9 | 0.322 | 22.6 | 0.324 | 29.5 | 0.326 | 38.3 | 0.328 | 47.4 |
| 0.330 | 55.1 | 0.332 | 60.0 | 0.334 | 64.8 | 0.336 | 67.3 | 0.338 | 70.2 |
| 0.340 | 72.5 | 0.342 | 73.6 | 0.344 | 75.1 | 0.346 | 76.6 | 0.348 | 77.4 |
| 0.350 | 78.1 | 0.352 | 78.8 | 0.354 | 79.3 | 0.356 | 80.5 | 0.358 | 81.7 |
| 0.360 | 81.8 | 0.365 | 83.1 | 0.370 | 84.3 | 0.375 | 85.2 | 0.380 | 86.4 |
| 0.385 | 87.0 | 0.390 | 87.6 | 0.395 | 88.6 | 0.400 | 88.6 | 0.405 | 89.0 |
| 0.410 | 89.7 | 0.415 | 90.2 | 0.420 | 90.4 | 0.425 | 90.6 | 0.430 | 90.8 |
| 0.435 | 90.8 | 0.440 | 91.4 | 0.445 | 91.1 | 0.450 | 91.5 | 0.455 | 92.0 |
| 0.460 | 92.1 | 0.465 | 92.1 | 0.470 | 92.2 | 0.475 | 91.9 | 0.480 | 92.4 |
| 0.485 | 92.3 | 0.490 | 92.3 | 0.495 | 92.4 | 0.500 | 92.3 | 0.505 | 92.5 |
| 0.510 | 92.5 | 0.515 | 92.7 | 0.520 | 92.6 | 0.525 | 92.9 | 0.530 | 93.1 |
| 0.535 | 93.0 | 0.540 | 93.1 | 0.545 | 93.7 | 0.550 | 93.7 | 0.555 | 93.7 |
| 0.560 | 93.9 | 0.565 | 94.3 | 0.570 | 94.0 | 0.575 | 94.1 | 0.580 | 94.2 |
| 0.585 | 94.7 | 0.590 | 94.7 | 0.595 | 94.4 | 0.600 | 95.0 | 0.605 | 94.5 |
| 0.610 | 94.9 | 0.615 | 94.8 | 0.620 | 94.7 | 0.625 | 95.0 | 0.630 | 94.7 |
| 0.635 | 94.7 | 0.640 | 94.8 | 0.645 | 94.4 | 0.650 | 94.4 | 0.655 | 94.4 |
| 0.660 | 94.5 | 0.665 | 94.4 | 0.670 | 94.4 | 0.675 | 94.6 | 0.680 | 94.5 |
| 0.685 | 94.5 | 0.690 | 94.3 | 0.695 | 94.4 | 0.700 | 94.6 | 0.720 | 94.3 |
| 0.740 | 94.5 | 0.760 | 94.4 | 0.780 | 94.6 | 0.800 | 94.6 | 0.820 | 94.6 |
| 0.840 | 94.7 | 0.860 | 95.1 | 0.880 | 95.2 | 0.900 | 95.2 | 0.920 | 95.2 |
| 0.940 | 95.0 | 0.960 | 95.4 | 0.980 | 95.6 | 1.000 | 95.3 | 1.020 | 95.5 |
| 1.040 | 95.3 | 1.060 | 95.5 | 1.080 | 95.6 | 1.100 | 95.7 | 1.120 | 95.5 |
| 1.140 | 95.5 | 1.160 | 95.6 | 1.180 | 95.6 | 1.200 | 95.6 | 1.220 | 95.7 |
| 1.240 | 95.6 | 1.260 | 95.7 | 1.280 | 95.6 | 1.300 | 95.5 | 1.320 | 94.7 |
| 1.340 | 93.2 | 1.360 | 92.7 | 1.380 | 93.8 | 1.400 | 95.3 | 1.420 | 95.7 |
| 1.440 | 95.8 | 1.460 | 95.8 | 1.480 | 95.8 | 1.500 | 96.1 | 1.520 | 96.1 |
| 1.540 | 96.0 | 1.560 | 96.0 | 1.580 | 96.2 | 1.600 | 96.1 | 1.620 | 96.1 |
| 1.640 | 96.2 | 1.660 | 96.2 | 1.680 | 96.1 | 1.700 | 96.1 | 1.720 | 96.1 |
| 1.740 | 96.3 | 1.760 | 96.1 | 1.780 | 96.0 | 1.800 | 96.0 | 1.820 | 96.0 |
| 1.840 | 96.0 | 1.860 | 96.2 | 1.880 | 96.1 | 1.900 | 96.3 | 1.920 | 96.2 |
| 1.940 | 96.4 | 1.960 | 96.3 | 1.980 | 96.2 | 2.000 | 96.0 | 2.020 | 95.8 |
| 2.040 | 95.6 | 2.060 | 95.6 | 2.080 | 95.3 | 2.100 | 95.0 | 2.120 | 94.2 |
| 2.140 | 92.3 | 2.160 | 88.9 | 2.180 | 85.2 | 2.200 | 82.0 | 2.220 | 81.3 |
| 2.240 | 83.0 | 2.260 | 86.0 | 2.280 | 88.9 | 2.300 | 91.2 | 2.320 | 92.6 |
| 2.340 | 93.1 | 2.360 | 93.2 | 2.380 | 92.9 | 2.400 | 92.2 | 2.420 | 91.2 |
| 2.440 | 89.7 | 2.460 | 88.8 | 2.480 | 86.6 | 2.500 | 84.7 | | |

FIGURE , EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON 71-1 23 AUG 78 710140004

THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU IN SITU, AFTER 315 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.101

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 7.0 | 0.252 | 7.0 | 0.254 | 6.7 | 0.256 | 6.8 | 0.258 | 6.7 |
| 0.260 | 6.7 | 0.262 | 6.7 | 0.264 | 5.6 | 0.266 | 6.5 | 0.268 | 6.7 |
| 0.270 | 6.5 | 0.272 | 6.3 | 0.274 | 6.3 | 0.276 | 6.3 | 0.278 | 6.3 |
| 0.280 | 6.6 | 0.282 | 7.0 | 0.284 | 7.6 | 0.286 | 8.3 | 0.288 | 8.9 |
| 0.290 | 9.6 | 0.292 | 10.1 | 0.294 | 10.7 | 0.296 | 10.8 | 0.298 | 10.7 |
| 0.300 | 10.2 | 0.302 | 10.1 | 0.304 | 9.[illegible] | 0.306 | 9.1 | 0.308 | 8.6 |
| 0.310 | 8.6 | 0.312 | 8.9 | 0.314 | 9.6 | 0.316 | 11.1 | 0.318 | 13.2 |
| 0.320 | 16.5 | 0.322 | 21.5 | 0.324 | 29.0 | 0.326 | 36.9 | 0.328 | 45.6 |
| 0.330 | 52.8 | 0.332 | 57.7 | 0.334 | 62.5 | 0.336 | 65.6 | 0.338 | 67.6 |
| 0.340 | 69.8 | 0.342 | 71.3 | 0.344 | 72.6 | 0.346 | 73.9 | 0.348 | 75.1 |
| 0.350 | 75.7 | 0.352 | 76.1 | 0.354 | 77.1 | 0.356 | 77.4 | 0.358 | 78.0 |
| 0.360 | 79.0 | 0.365 | 80.5 | 0.370 | 81.6 | 0.375 | 82.6 | 0.380 | 83.6 |
| 0.385 | 84.5 | 0.390 | 85.2 | 0.395 | 85.8 | 0.400 | 86.2 | 0.405 | 86.8 |
| 0.410 | 87.4 | 0.415 | 87.7 | 0.420 | 88.3 | 0.425 | 88.7 | 0.430 | 88.9 |
| 0.435 | 89.[illegible] | 0.440 | 89.5 | 0.445 | 89.4 | 0.450 | 89.8 | 0.455 | 89.9 |
| 0.460 | 90.4 | 0.465 | 90.3 | 0.470 | 90.5 | 0.475 | 90.3 | 0.480 | 90.8 |
| 0.485 | 90.4 | 0.490 | 90.7 | 0.495 | 91.1 | 0.500 | 91.0 | 0.505 | 91.3 |
| 0.510 | 91.1 | 0.515 | 91.4 | 0.520 | 91.3 | 0.525 | 91.8 | 0.530 | 91.9 |
| 0.535 | 92.0 | 0.540 | 92.4 | 0.545 | 92.6 | 0.550 | 92.4 | 0.555 | 92.7 |
| 0.560 | 92.5 | 0.565 | 92.9 | 0.570 | 93.1 | 0.575 | 93.2 | 0.580 | 93.3 |
| 0.585 | 93.7 | 0.590 | 93.8 | 0.595 | 93.8 | 0.600 | 94.0 | 0.605 | 93.8 |
| 0.610 | 93.7 | 0.615 | 93.9 | 0.620 | 93.9 | 0.625 | 94.2 | 0.630 | 93.9 |
| 0.635 | 94.0 | 0.640 | 94.0 | 0.645 | 93.6 | 0.650 | 94.0 | 0.655 | 93.6 |
| 0.660 | 94.1 | 0.665 | 93.7 | 0.670 | 93.8 | 0.675 | 94.0 | 0.680 | 93.9 |
| 0.685 | 93.8 | 0.690 | 93.8 | 0.695 | 93.9 | 0.700 | 93.8 | 0.720 | 94.3 |
| 0.740 | 94.2 | 0.760 | 94.1 | 0.780 | 94.3 | 0.800 | 94.3 | 0.820 | 94.2 |
| 0.840 | 94.3 | 0.860 | 94.8 | 0.880 | 94.[illegible] | 0.900 | 95.1 | 0.920 | 94.9 |
| 0.940 | 95.0 | 0.960 | 95.1 | 0.980 | 95.6 | 1.000 | 95.3 | 1.020 | 95.6 |
| 1.040 | 95.2 | 1.060 | 95.4 | 1.080 | 95.4 | 1.100 | 95.7 | 1.120 | 95.6 |
| 1.140 | 95.5 | 1.160 | 95.5 | 1.180 | 95.5 | 1.200 | 95.5 | 1.220 | 95.7 |
| 1.240 | 95.6 | 1.260 | 95.7 | 1.280 | 95.6 | 1.300 | 95.6 | 1.320 | 94.7 |
| 1.340 | 93.2 | 1.360 | 93.0 | 1.380 | 93.9 | 1.400 | 95.4 | 1.420 | 95.8 |
| 1.440 | 95.9 | 1.460 | 95.9 | 1.480 | 96.0 | 1.500 | 96.1 | 1.520 | 96.0 |
| 1.540 | 95.9 | 1.560 | 95.9 | 1.580 | 96.0 | 1.600 | 95.9 | 1.620 | 96.0 |
| 1.640 | 96.1 | 1.660 | 96.1 | 1.680 | 96.2 | 1.700 | 96.2 | 1.720 | 96.1 |
| 1.740 | 96.1 | 1.760 | 96.3 | 1.780 | 96.1 | 1.800 | 96.1 | 1.820 | 96.1 |
| 1.840 | 96.1 | 1.860 | 96.2 | 1.880 | 96.1 | 1.900 | 96.2 | 1.920 | 96.2 |
| 1.940 | 96.4 | 1.960 | 96.3 | 1.980 | 96.2 | 2.000 | 96.1 | 2.020 | 95.9 |
| 2.040 | 95.6 | 2.060 | 95.5 | 2.080 | 95.3 | 2.100 | 94.9 | 2.120 | 94.1 |
| 2.140 | 92.0 | 2.160 | 88.8 | 2.180 | 84.9 | 2.200 | 82.2 | 2.220 | 81.8 |
| 2.240 | 83.1 | 2.260 | 86.0 | 2.280 | 88.9 | 2.300 | 91.0 | 2.320 | 92.5 |
| 2.340 | 93.2 | 2.360 | 93.2 | 2.380 | 92.8 | 2.400 | 92.2 | 2.420 | 91.2 |
| 2.440 | 89.8 | 2.460 | 88.4 | 2.480 | 86.5 | 2.500 | 84.6 | | |

FIGURE , EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON 71-1 23 AUG 78 710140005

THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU IN SITU, AFTER 503 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.108

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 7.3 | 0.252 | 7.1 | 0.254 | 7.2 | 0.256 | 7.1 | 0.258 | 7.1 |
| 0.260 | 7.1 | 0.262 | 7.1 | 0.264 | 7.0 | 0.266 | 6.9 | 0.268 | 6.8 |
| 0.270 | 6.9 | 0.272 | 6.8 | 0.274 | 6.7 | 0.276 | 6.8 | 0.278 | 6.8 |
| 0.280 | 6.9 | 0.282 | 7.1 | 0.284 | 7.6 | 0.286 | 8.4 | 0.288 | 9.2 |
| 0.290 | 9.8 | 0.292 | 10.5 | 0.294 | 10.6 | 0.296 | 10.9 | 0.298 | 10.9 |
| 0.300 | 10.7 | 0.302 | 10.0 | 0.304 | 9.6 | 0.306 | 9.4 | 0.308 | 9.0 |
| 0.310 | 8.8 | 0.312 | 9.3 | 0.314 | 10.0 | 0.316 | 11.3 | 0.318 | 13.5 |
| 0.320 | 16.4 | 0.322 | 21.6 | 0.324 | 20.7 | 0.326 | 36.6 | 0.328 | 44.5 |
| 0.330 | 51.3 | 0.332 | 56.1 | 0.334 | 59.8 | 0.336 | 62.6 | 0.338 | 65.4 |
| 0.340 | 67.3 | 0.342 | 68.8 | 0.344 | 70.4 | 0.346 | 70.9 | 0.348 | 72.4 |
| 0.350 | 72.8 | 0.352 | 74.1 | 0.354 | 74.7 | 0.356 | 75.3 | 0.358 | 75.[illegible] |
| 0.360 | 76.8 | 0.365 | 78.3 | 0.370 | 79.4 | 0.375 | 80.3 | 0.380 | 81.[illegible] |
| 0.385 | 82.5 | 0.390 | 83.0 | 0.395 | 83.9 | 0.400 | 84.2 | 0.405 | 85.1 |
| 0.410 | 85.7 | 0.415 | 86.1 | 0.420 | 86.[illegible] | 0.425 | 86.6 | 0.430 | 87.3 |
| 0.435 | 87.4 | 0.440 | 87.7 | 0.445 | 88.[illegible] | 0.450 | 88.3 | 0.455 | 88.5 |
| 0.460 | 88.9 | 0.465 | 88.7 | 0.470 | 88.6 | 0.475 | 89.0 | 0.480 | 89.4 |
| 0.485 | 89.6 | 0.490 | 89.5 | 0.495 | 90.1 | 0.500 | 89.5 | 0.505 | 90.3 |
| 0.510 | 90.2 | 0.515 | 90.2 | 0.520 | 90.4 | 0.525 | 90.9 | 0.530 | 91.1 |
| 0.535 | 90.[illegible] | 0.540 | 91.6 | 0.545 | 91.8 | 0.550 | 91.9 | 0.555 | 91.9 |
| 0.560 | 91.8 | 0.565 | 92.0 | 0.570 | 92.6 | 0.575 | 92.6 | 0.580 | 92.8 |
| 0.585 | 93.1 | 0.590 | 93.4 | 0.595 | 93.0 | 0.600 | 93.5 | 0.605 | 93.0 |
| 0.610 | 93.3 | 0.615 | 93.2 | 0.620 | 93.3 | 0.625 | 93.4 | 0.630 | 93.3 |
| 0.635 | 93.5 | 0.640 | 93.4 | 0.645 | 93.2 | 0.650 | [illegible].1 | 0.655 | 93.5 |
| 0.660 | 93.1 | 0.665 | 92.9 | 0.670 | 93.1 | 0.675 | 93.8 | 0.680 | 93.3 |
| 0.685 | 93.6 | 0.690 | 93.3 | 0.695 | 93.4 | 0.700 | 93.4 | 0.720 | 93.5 |
| 0.740 | 93.6 | 0.760 | 93.6 | 0.780 | 93.8 | 0.800 | 94.[illegible] | 0.820 | 94.1 |
| 0.840 | 94.1 | 0.860 | 94.4 | 0.880 | 94.5 | 0.900 | 94.6 | 0.920 | 94.6 |
| 0.940 | 94.5 | 0.960 | 95.1 | 0.980 | 95.1 | 1.000 | 95.0 | 1.020 | 95.2 |
| 1.040 | 94.8 | 1.060 | 95.2 | 1.080 | 95.2 | 1.100 | 95.4 | 1.120 | 95.2 |
| 1.140 | 95.3 | 1.160 | 95.4 | 1.180 | 95.2 | 1.200 | 95.3 | 1.220 | 95.4 |
| 1.240 | 95.5 | 1.260 | 95.6 | 1.280 | 95.5 | 1.300 | 95.3 | 1.320 | [illegible]4.3 |
| 1.340 | 93.1 | 1.360 | 92.7 | 1.380 | 93.5 | 1.400 | 94.8 | 1.420 | 95.5 |
| 1.440 | 95.5 | 1.460 | 95.6 | 1.480 | 95.7 | 1.500 | 95.8 | 1.520 | 95.7 |
| 1.540 | 95.8 | 1.560 | 95.9 | 1.580 | 95.9 | 1.600 | 95.7 | 1.620 | 95.9 |
| 1.640 | 95.8 | 1.660 | 95.8 | 1.680 | 95.8 | 1.700 | 95.7 | 1.720 | 95.9 |
| 1.740 | 96.0 | 1.760 | 95.9 | 1.780 | 95.8 | 1.800 | 95.7 | 1.820 | 95.7 |
| 1.840 | 95.7 | 1.860 | 95.9 | 1.880 | 95.8 | 1.900 | 96.0 | 1.920 | 95.[illegible] |
| 1.940 | 96.0 | 1.960 | 95.[illegible] | 1.980 | 95.8 | 2.000 | 95.7 | 2.020 | 95.5 |
| 2.040 | 95.4 | 2.060 | 95.4 | 2.080 | 95.1 | 2.100 | 94.6 | 2.120 | 93.8 |
| 2.140 | 91.9 | 2.160 | 88.6 | 2.180 | 85.1 | 2.200 | 82.4 | 2.220 | 81.8 |
| 2.240 | 83.2 | 2.260 | 85.4 | 2.280 | 88.3 | 2.300 | 90.6 | 2.320 | 92.1 |
| 2.340 | 92.8 | 2.360 | 92.9 | 2.380 | 92.4 | 2.400 | 91.7 | 2.420 | 90.7 |
| 2.440 | 89.2 | 2.460 | 88.1 | 2.480 | 86.3 | 2.500 | 84.3 | | |

FIGURE . EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON 71-2 23 AUG 78 710240001

THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU IN VACUUM, BEFORE EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.083

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 6.1 | 0.252 | 6.0 | 0.254 | 6.0 | 0.256 | 6.0 | 0.258 | 6.0 |
| 0.260 | 5.9 | 0.262 | 6.1 | 0.264 | 5.9 | 0.266 | 5.8 | 0.268 | 5.7 |
| 0.270 | 5.7 | 0.272 | 5.5 | 0.274 | 5.6 | 0.276 | 5.6 | 0.278 | 5.6 |
| 0.280 | 5.9 | 0.282 | 6.2 | 0.284 | 6.8 | 0.286 | 7.7 | 0.288 | 8.5 |
| 0.290 | 9.3 | 0.292 | 10.1 | 0.294 | 10.4 | 0.296 | [illegible] | 0.298 | 10.7 |
| 0.300 | 10.6 | 0.302 | 10.0 | 0.304 | 9.8 | 0.306 | 8.9 | 0.308 | 8.5 |
| 0.310 | 8.2 | 0.312 | 8.1 | 0.314 | 8.2 | 0.316 | 9.2 | 0.318 | 11.2 |
| 0.320 | 14.6 | 0.322 | 21.2 | 0.324 | 28.9 | 0.326 | 39.3 | 0.328 | 49.3 |
| 0.330 | 58.6 | 0.332 | 65.1 | 0.334 | 69.6 | 0.336 | 72.4 | 0.338 | 75.6 |
| 0.340 | 77.4 | 0.342 | 79.1 | 0.344 | 80.3 | 0.346 | 81.8 | 0.348 | 82.5 |
| 0.350 | 83.3 | 0.352 | 83.9 | 0.354 | 84.2 | 0.356 | 85.3 | 0.358 | 86.8 |
| 0.360 | 86.3 | 0.365 | 87.6 | 0.370 | 88.5 | 0.375 | 89.4 | 0.380 | 90.1 |
| 0.385 | 91.1 | 0.390 | 91.6 | 0.395 | 91.7 | 0.400 | 92.0 | 0.405 | 91.9 |
| 0.410 | 92.7 | 0.415 | 93.1 | 0.420 | 93.4 | 0.425 | 93.5 | 0.430 | 94.0 |
| 0.435 | 93.9 | 0.440 | 94.1 | 0.445 | 93.7 | 0.450 | 94.1 | 0.455 | 94.4 |
| 0.460 | 94.6 | 0.465 | 94.1 | 0.470 | 94.0 | 0.475 | 93.9 | 0.480 | 94.2 |
| 0.485 | 94.0 | 0.490 | 94.2 | 0.495 | 94.1 | 0.500 | 94.0 | 0.505 | 94.5 |
| 0.510 | 93.9 | 0.515 | 94.3 | 0.520 | 94.0 | 0.525 | 94.4 | 0.530 | 94.6 |
| 0.535 | 94.7 | 0.540 | 94.7 | 0.545 | 94.7 | 0.550 | 94.7 | 0.555 | 94.8 |
| 0.560 | 94.7 | 0.565 | 95.1 | 0.570 | 95.3 | 0.575 | 95.2 | 0.580 | 95.0 |
| 0.585 | 95.7 | 0.590 | 95.6 | 0.595 | 95.3 | 0.600 | 95.6 | 0.605 | 95.4 |
| 0.610 | 95.6 | 0.615 | 95.6 | 0.620 | 95.5 | 0.625 | 95.6 | 0.630 | 95.6 |
| 0.635 | 95.8 | 0.640 | 95.5 | 0.645 | 95.7 | 0.650 | 95.4 | 0.655 | 95.3 |
| 0.660 | 95.6 | 0.665 | 95.6 | 0.670 | 95.4 | 0.675 | 95.9 | 0.680 | 95.5 |
| 0.685 | 95.5 | 0.690 | 95.5 | 0.695 | 95.6 | 0.700 | 95.4 | 0.720 | 95.2 |
| 0.740 | 95.4 | 0.760 | 95.4 | 0.780 | 95.4 | 0.800 | 95.4 | 0.820 | 95.4 |
| 0.840 | 95.3 | 0.860 | 95.6 | 0.880 | 95.7 | 0.900 | 95.7 | 0.920 | 95.7 |
| 0.940 | 95.6 | 0.960 | 95.8 | 0.980 | 95.9 | 1.000 | 95.8 | 1.020 | 95.9 |
| 1.040 | 95.6 | 1.060 | 95.9 | 1.080 | 95.8 | 1.100 | 96.0 | 1.120 | 95.8 |
| 1.140 | 95.7 | 1.160 | 95.9 | 1.180 | 95.7 | 1.200 | 95.9 | 1.220 | 95.9 |
| 1.240 | 96.0 | 1.260 | 96.1 | 1.280 | 95.8 | 1.300 | 95.6 | 1.320 | 95.0 |
| 1.340 | 93.4 | 1.360 | 92.9 | 1.380 | 94.0 | 1.400 | 95.5 | 1.420 | 96.0 |
| 1.440 | 96.0 | 1.460 | 96.1 | 1.480 | 96.2 | 1.500 | 96.4 | 1.520 | 96.2 |
| 1.540 | 96.2 | 1.560 | 96.4 | 1.580 | 96.5 | 1.600 | 96.3 | 1.620 | 96.5 |
| 1.640 | 96.6 | 1.660 | 96.5 | 1.680 | 96.6 | 1.700 | 96.5 | 1.720 | 96.4 |
| 1.740 | 96.6 | 1.760 | 96.6 | 1.780 | 96.5 | 1.800 | 96.5 | 1.820 | 96.4 |
| 1.840 | 96.5 | 1.860 | 96.7 | 1.880 | 96.8 | 1.900 | 96.9 | 1.920 | 96.7 |
| 1.940 | 97.0 | 1.960 | 96.8 | 1.980 | 96.7 | 2.000 | 96.7 | 2.020 | 96.4 |
| 2.040 | 96.2 | 2.060 | 96.2 | 2.080 | 96.0 | 2.100 | 95.5 | 2.120 | 94.7 |
| 2.140 | 92.7 | 2.160 | 89.3 | 2.180 | 85.3 | 2.200 | 82.2 | 2.220 | 81.4 |
| 2.240 | 83.3 | 2.260 | 86.4 | 2.280 | 89.5 | 2.300 | 91.7 | 2.320 | 93.3 |
| 2.340 | 93.9 | 2.360 | 93.9 | 2.380 | 93.6 | 2.400 | 93.0 | 2.420 | 91.9 |
| 2.440 | 90.4 | 2.460 | 89.2 | 2.480 | 87.4 | 2.500 | 85.4 | | |

FIGURE . EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON 71-2 23 AUG 78 710240002

THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU IN SITU, AFTER 50 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0,088

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0,230 | 0,0 | 0,232 | 0,0 | 0,234 | 0,0 | 0,236 | 0,0 | 0,238 | 0,0 |
| 0,240 | 0,0 | 0,242 | 0,0 | 0,244 | 0,0 | 0,246 | 0,0 | 0,248 | 0,0 |
| 0,250 | 6,3 | 0,252 | 6,3 | 0,254 | 6,3 | 0,256 | 6,3 | 0,258 | 6,3 |
| 0,260 | 6,2 | 0,262 | 6,1 | 0,264 | 6,0 | 0,266 | 6,0 | 0,268 | 5,9 |
| 0,270 | 5,9 | 0,272 | 5,8 | 0,274 | 5,9 | 0,276 | 5,8 | 0,278 | 5,9 |
| 0,280 | 6,1 | 0,282 | 6,5 | 0,284 | 7,0 | 0,286 | 7,8 | 0,288 | 8,8 |
| 0,290 | 9,5 | 0,292 | 10,0 | 0,294 | 10,5 | 0,296 | 10,9 | 0,298 | 10,9 |
| 0,300 | 10,6 | 0,302 | 10,2 | 0,304 | 9,6 | 0,306 | 9,1 | 0,308 | 8,5 |
| 0,310 | 8,2 | 0,312 | 9,1 | 0,314 | 8,5 | 0,316 | 9,4 | 0,318 | 11,3 |
| 0,320 | 14,8 | 0,322 | 20,9 | 0,324 | 29,2 | 0,326 | 39,4 | 0,328 | 49,4 |
| 0,330 | 58,1 | 0,332 | 65,1 | 0,334 | 69,5 | 0,336 | 72,6 | 0,338 | 75,1 |
| 0,340 | 77,6 | 0,342 | 78,4 | 0,344 | 80,0 | 0,346 | 80,6 | 0,348 | 81,7 |
| 0,350 | 82,3 | 0,352 | 83,9 | 0,354 | 84,0 | 0,356 | 85,3 | 0,358 | 85,2 |
| 0,360 | 85,0 | 0,365 | 86,0 | 0,370 | 87,1 | 0,375 | 87,5 | 0,380 | 88,6 |
| 0,385 | 89,5 | 0,390 | 89,5 | 0,395 | 89,9 | 0,400 | 90,2 | 0,405 | 90,8 |
| 0,410 | 91,2 | 0,415 | 91,1 | 0,420 | 91,8 | 0,425 | 91,8 | 0,430 | 92,3 |
| 0,435 | 92,4 | 0,440 | 92,6 | 0,445 | 92,5 | 0,450 | 92,7 | 0,455 | 93,1 |
| 0,460 | 92,7 | 0,465 | 92,7 | 0,470 | 92,4 | 0,475 | 92,4 | 0,480 | 93,0 |
| 0,485 | 92,7 | 0,490 | 92,5 | 0,495 | 92,9 | 0,500 | 92,7 | 0,505 | 93,1 |
| 0,510 | 93,0 | 0,515 | 93,2 | 0,520 | 93,1 | 0,525 | 93,3 | 0,530 | 93,3 |
| 0,535 | 93,5 | 0,540 | 93,7 | 0,545 | 93,8 | 0,550 | 93,9 | 0,555 | 93,9 |
| 0,560 | 93,9 | 0,565 | 94,4 | 0,570 | 94,5 | 0,575 | 94,1 | 0,580 | 94,6 |
| 0,585 | 94,5 | 0,590 | 94,7 | 0,595 | 94,5 | 0,600 | 95,1 | 0,605 | 94,8 |
| 0,610 | 94,9 | 0,615 | 94,8 | 0,620 | 95,1 | 0,625 | 95,0 | 0,630 | 94,9 |
| 0,635 | 94,9 | 0,640 | 94,8 | 0,645 | 94,6 | 0,650 | 95,0 | 0,655 | 94,5 |
| 0,660 | 94,7 | 0,665 | 94,9 | 0,670 | 94,8 | 0,675 | 95,3 | 0,680 | 95,0 |
| 0,685 | 94,9 | 0,690 | 94,9 | 0,695 | 95,2 | 0,700 | 95,3 | 0,720 | 95,5 |
| 0,740 | 95,3 | 0,760 | 95,3 | 0,780 | 95,6 | 0,800 | 95,4 | 0,820 | 95,3 |
| 0,840 | 95,2 | 0,860 | 95,3 | 0,880 | 95,5 | 0,900 | 95,5 | 0,920 | 95,6 |
| 0,940 | 95,5 | 0,960 | 95,8 | 0,980 | 95,8 | 1,000 | 95,7 | 1,020 | 95,9 |
| 1,040 | 95,7 | 1,060 | 96,0 | 1,080 | 95,9 | 1,100 | 96,0 | 1,120 | 95,9 |
| 1,140 | 95,7 | 1,160 | 95,9 | 1,180 | 95,8 | 1,200 | 95,9 | 1,220 | 95,9 |
| 1,240 | 96,0 | 1,260 | 95,9 | 1,280 | 95,7 | 1,300 | 95,8 | 1,320 | 95,1 |
| 1,340 | 93,3 | 1,360 | 93,0 | 1,380 | 93,8 | 1,400 | 95,5 | 1,420 | 95,9 |
| 1,440 | 96,0 | 1,460 | 96,1 | 1,480 | 96,2 | 1,500 | 96,3 | 1,520 | 96,3 |
| 1,540 | 96,3 | 1,560 | 96,2 | 1,580 | 96,4 | 1,600 | 96,3 | 1,620 | 96,4 |
| 1,640 | 96,5 | 1,660 | 96,5 | 1,680 | 96,6 | 1,700 | 96,4 | 1,720 | 96,4 |
| 1,740 | 96,7 | 1,760 | 96,5 | 1,780 | 96,4 | 1,800 | 96,4 | 1,820 | 96,4 |
| 1,840 | 96,4 | 1,860 | 96,6 | 1,880 | 96,5 | 1,900 | 96,8 | 1,920 | 96,6 |
| 1,940 | 95,9 | 1,960 | 96,7 | 1,980 | 96,6 | 2,000 | 96,5 | 2,020 | 96,1 |
| 2,040 | 96,1 | 2,060 | 96,1 | 2,080 | 96,0 | 2,100 | 95,3 | 2,120 | 94,8 |
| 2,140 | 92,9 | 2,160 | 89,8 | 2,180 | 85,4 | 2,200 | 82,0 | 2,220 | 81,6 |
| 2,240 | 8[illegible],1 | 2,260 | 86,3 | 2,280 | 89,2 | 2,300 | 91,4 | 2,320 | 93,1 |
| 2,340 | 93,7 | 2,360 | 93,9 | 2,380 | 93,5 | 2,400 | 92,7 | 2,420 | 91,7 |
| 2,440 | 90,4 | 2,460 | 89,1 | 2,480 | 87,1 | -,500 | 85,2 | | |



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FIGURE . EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON 71-2 23 AUG 78 710280003

THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU IN SITU, AFTER 154 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.090

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 6.8 | 0.252 | 6.8 | 0.254 | 6.7 | 0.256 | 6.8 | 0.258 | 6.6 |
| 0.260 | 6.7 | 0.262 | 6.6 | 0.264 | 6.6 | 0.266 | 6.6 | 0.268 | 6.4 |
| 0.270 | 6.3 | 0.272 | 6.4 | 0.274 | 6.2 | 0.276 | 6.3 | 0.278 | 6.5 |
| 0.280 | 6.7 | 0.282 | 7.1 | 0.284 | 7.7 | 0.286 | 8.5 | 0.288 | 9.2 |
| 0.290 | 10.0 | 0.292 | 10.7 | 0.294 | 11.0 | 0.296 | 11.2 | 0.298 | 11.2 |
| 0.300 | 10.8 | 0.302 | 10.4 | 0.304 | 9.7 | 0.306 | 9.3 | 0.308 | 8.8 |
| 0.310 | 8.7 | 0.312 | 8.7 | 0.314 | 9.0 | 0.316 | 9.8 | 0.318 | 11.8 |
| 0.320 | 15.7 | 0.322 | 21.4 | 0.324 | 29.8 | 0.326 | 39.9 | 0.328 | 49.3 |
| 0.330 | 57.6 | 0.332 | 63.7 | 0.334 | 68.1 | 0.336 | 71.0 | 0.338 | 73.2 |
| 0.340 | 75.5 | 0.342 | 77.0 | 0.344 | 77.5 | 0.346 | 78.8 | 0.348 | 80.1 |
| 0.350 | 81.0 | 0.352 | 81.3 | 0.354 | 82.4 | 0.356 | 82.5 | 0.358 | 84.1 |
| 0.360 | 84.1 | 0.365 | 85.0 | 0.370 | 86.4 | 0.375 | 87.3 | 0.380 | 88.0 |
| 0.385 | 88.7 | 0.390 | 89.2 | 0.395 | 89.8 | 0.400 | 90.0 | 0.405 | 89.9 |
| 0.410 | 90.8 | 0.415 | 90.9 | 0.420 | 91.5 | 0.425 | 91.3 | 0.430 | 91.8 |
| 0.435 | 91.8 | 0.440 | 92.0 | 0.445 | 91.7 | 0.450 | 92.2 | 0.455 | 92.7 |
| 0.460 | 92.9 | 0.465 | 92.3 | 0.470 | 92.7 | 0.475 | 92.3 | 0.480 | 92.8 |
| 0.485 | 92.8 | 0.490 | 92.7 | 0.495 | 92.8 | 0.500 | 92.6 | 0.505 | 92.9 |
| 0.510 | 92.5 | 0.515 | 93.0 | 0.520 | 92.8 | 0.525 | 93.1 | 0.530 | 93.4 |
| 0.535 | 93.3 | 0.540 | 93.4 | 0.545 | 93.8 | 0.550 | 93.7 | 0.555 | 93.9 |
| 0.560 | 93.7 | 0.565 | 94.3 | 0.570 | 94.0 | 0.575 | 94.1 | 0.580 | 94.2 |
| 0.585 | 94.8 | 0.590 | 94.8 | 0.595 | 94.4 | 0.600 | 95.0 | 0.605 | 94.6 |
| 0.610 | 95.0 | 0.615 | 94.7 | 0.620 | 94.6 | 0.625 | 94.9 | 0.630 | 94.9 |
| 0.635 | 94.8 | 0.640 | 94.9 | 0.645 | 94.6 | 0.650 | 95.5 | 0.655 | 94.6 |
| 0.660 | 94.5 | 0.665 | 94.4 | 0.670 | 94.5 | 0.675 | 94.8 | 0.680 | 94.6 |
| 0.685 | 95.0 | 0.690 | 94.5 | 0.695 | 94.9 | 0.700 | 95.0 | 0.720 | 94.4 |
| 0.740 | 94.5 | 0.760 | 94.7 | 0.780 | 94.8 | 0.800 | 94.8 | 0.820 | 94.8 |
| 0.840 | 94.8 | 0.860 | 95.3 | 0.880 | 95.3 | 0.900 | 95.3 | 0.920 | 95.4 |
| 0.940 | 95.2 | 0.960 | 95.5 | 0.980 | 95.6 | 1.000 | 95.5 | 1.020 | 95.7 |
| 1.040 | 95.4 | 1.060 | 95.7 | 1.080 | 95.7 | 1.100 | 96.0 | 1.120 | 95.8 |
| 1.140 | 95.5 | 1.160 | 95.9 | 1.180 | 95.7 | 1.200 | 95.8 | 1.220 | 96.0 |
| 1.240 | 95.9 | 1.260 | 96.0 | 1.280 | 95.9 | 1.300 | 95.7 | 1.320 | 96.1 |
| 1.340 | 93.5 | 1.360 | 93.1 | 1.380 | 94.0 | 1.400 | 95.5 | 1.420 | 96.1 |
| 1.440 | 95.1 | 1.460 | 96.2 | 1.480 | 96.2 | 1.500 | 96.4 | 1.520 | 96.4 |
| 1.540 | 95.3 | 1.560 | 96.4 | 1.580 | 96.5 | 1.600 | 96.4 | 1.620 | 96.5 |
| 1.640 | 96.6 | 1.660 | 96.6 | 1.680 | 96.6 | 1.700 | 96.5 | 1.720 | 96.5 |
| 1.740 | 96.7 | 1.760 | 96.6 | 1.780 | 96.5 | 1.800 | 96.5 | 1.820 | 96.5 |
| 1.840 | 96.6 | 1.860 | 96.7 | 1.880 | 96.7 | 1.900 | 96.9 | 1.920 | 96.7 |
| 1.940 | 96.9 | 1.960 | 96.9 | 1.980 | 96.8 | 2.000 | 96.4 | 2.020 | 96.5 |
| 2.040 | 96.2 | 2.060 | 96.3 | 2.080 | 95.8 | 2.100 | 95.5 | 2.120 | 94.9 |
| 2.140 | 92.9 | 2.160 | 89.5 | 2.180 | 85.5 | 2.200 | 82.8 | 2.220 | 82.1 |
| 2.240 | 83.5 | 2.260 | 86.5 | 2.280 | 89.3 | 2.300 | 91.6 | 2.320 | 93.1 |
| 2.340 | 93.7 | 2.360 | 93.8 | 2.380 | 93.5 | 2.400 | 92.8 | 2.420 | 91.7 |
| 2.440 | 90.3 | 2.460 | 89.1 | 2.480 | 87.1 | 2.500 | 85.1 | | |

FIGURE . EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON 71-2 23 AUG 78 710280008

THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU IN SITU, AFTER 313 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.097

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 7.0 | 0.252 | 7.0 | 0.254 | 7.0 | 0.256 | 7.1 | 0.258 | 7.1 |
| 0.260 | 6.8 | 0.262 | 6.8 | 0.264 | 6.8 | 0.266 | 6.8 | 0.268 | 6.7 |
| 0.270 | 6.5 | 0.272 | 6.6 | 0.274 | 6.5 | 0.276 | 6.4 | 0.278 | 6.7 |
| 0.280 | 6.7 | 0.282 | 7.0 | 0.284 | 7.7 | 0.286 | 8.4 | 0.288 | 8.9 |
| 0.290 | 9.9 | 0.292 | 10.3 | 0.294 | 10.9 | 0.296 | 11.2 | 0.298 | 11.0 |
| 0.300 | 10.8 | 0.302 | 10.3 | 0.304 | 9.8 | 0.306 | 9.1 | 0.308 | 8.9 |
| 0.310 | 8.6 | 0.312 | 8.5 | 0.314 | 8.8 | 0.316 | 9.7 | 0.318 | 11.5 |
| 0.320 | 15.0 | 0.322 | 20.8 | 0.324 | 29.2 | 0.326 | 38.1 | 0.328 | 47.6 |
| 0.330 | 55.8 | 0.332 | 61.6 | 0.334 | 66.2 | 0.336 | 68.9 | 0.338 | 70.9 |
| 0.340 | 73.3 | 0.342 | 74.5 | 0.344 | 76.1 | 0.346 | 76.4 | 0.348 | 77.8 |
| 0.350 | 78.7 | 0.352 | 79.1 | 0.354 | 80.3 | 0.356 | 80.4 | 0.358 | 81.5 |
| 0.360 | 81.2 | 0.365 | 82.4 | 0.370 | 83.5 | 0.375 | 84.5 | 0.380 | 85.4 |
| 0.385 | 86.1 | 0.390 | 86.6 | 0.395 | 87.4 | 0.400 | 87.6 | 0.405 | 87.9 |
| 0.410 | 88.5 | 0.415 | 88.7 | 0.420 | 89.3 | 0.425 | 89.8 | 0.430 | 90.0 |
| 0.435 | 90.2 | 0.440 | 90.2 | 0.445 | 89.9 | 0.450 | 90.6 | 0.455 | 90.8 |
| 0.460 | 91.0 | 0.465 | 90.7 | 0.470 | 90.8 | 0.475 | 90.7 | 0.480 | 91.2 |
| 0.485 | 90.7 | 0.490 | 91.2 | 0.495 | 91.3 | 0.500 | 91.2 | 0.505 | 91.5 |
| 0.510 | 91.4 | 0.515 | 91.6 | 0.520 | 91.9 | 0.525 | 91.8 | 0.530 | 92.0 |
| 0.535 | 92.0 | 0.540 | 92.8 | 0.545 | 92.8 | 0.550 | 92.5 | 0.555 | 92.7 |
| 0.560 | 92.6 | 0.565 | 93.1 | 0.570 | 93.0 | 0.575 | 93.4 | 0.580 | 93.3 |
| 0.585 | 93.7 | 0.590 | 94.0 | 0.595 | 93.9 | 0.600 | 94.2 | 0.605 | 94.2 |
| 0.610 | 94.0 | 0.615 | 93.8 | 0.620 | 94.1 | 0.625 | 94.4 | 0.630 | 94.0 |
| 0.635 | 94.3 | 0.640 | 94.2 | 0.645 | 93.6 | 0.650 | 94.1 | 0.655 | 93.8 |
| 0.660 | 93.9 | 0.665 | 94.0 | 0.670 | 94.0 | 0.675 | 94.1 | 0.680 | 94.1 |
| 0.685 | 94.0 | 0.690 | 94.0 | 0.695 | 94.1 | 0.700 | 94.4 | 0.720 | 94.5 |
| 0.740 | 94.5 | 0.760 | 94.4 | 0.780 | 94.8 | 0.800 | 94.5 | 0.820 | 94.5 |
| 0.840 | 94.6 | 0.860 | 94.9 | 0.880 | 94.9 | 0.900 | 95.2 | 0.920 | 95.1 |
| 0.940 | 95.0 | 0.960 | 95.5 | 0.980 | 95.7 | 1.000 | 95.4 | 1.020 | 95.6 |
| 1.040 | 95.3 | 1.060 | 95.5 | 1.080 | 95.6 | 1.100 | 95.8 | 1.120 | 95.6 |
| 1.140 | 95.6 | 1.160 | 95.6 | 1.180 | 95.7 | 1.200 | 95.7 | 1.220 | 95.9 |
| 1.240 | 95.8 | 1.260 | 95.9 | 1.280 | 95.7 | 1.300 | 95.7 | 1.320 | 94.9 |
| 1.340 | 93.3 | 1.360 | 93.0 | 1.380 | 94.0 | 1.400 | 95.5 | 1.420 | 95.9 |
| 1.440 | 96.1 | 1.460 | 96.1 | 1.480 | 96.2 | 1.500 | 96.3 | 1.520 | 96.3 |
| 1.540 | 96.2 | 1.560 | 96.2 | 1.580 | 96.4 | 1.600 | 96.4 | 1.620 | 96.4 |
| 1.640 | 96.5 | 1.660 | 96.5 | 1.680 | 96.5 | 1.700 | 96.5 | 1.720 | 96.5 |
| 1.740 | 96.6 | 1.760 | 96.6 | 1.780 | 96.4 | 1.800 | 96.5 | 1.820 | 96.5 |
| 1.840 | 96.4 | 1.860 | 96.6 | 1.880 | 96.6 | 1.900 | 96.6 | 1.920 | 96.7 |
| 1.940 | 96.8 | 1.960 | 96.7 | 1.980 | 96.8 | 2.000 | 96.7 | 2.020 | 96.5 |
| 2.040 | 96.1 | 2.060 | 96.1 | 2.080 | 95.9 | 2.100 | 95.4 | 2.120 | 94.8 |
| 2.140 | 92.6 | 2.160 | 89.6 | 2.180 | 85.7 | 2.200 | 82.9 | 2.220 | 82.3 |
| 2.240 | 83.6 | 2.260 | 86.5 | 2.280 | 89.4 | 2.300 | 91.6 | 2.320 | 93.0 |
| 2.340 | 93.6 | 2.360 | 93.7 | 2.380 | 93.3 | 2.400 | 92.7 | 2.420 | 91.6 |
| 2.440 | 90.1 | 2.460 | 88.9 | 2.480 | 87.0 | 2.500 | 85.1 | | |

FIGURE . EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON 71-2 23 AUG 78 710240005

THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU IN SITU, AFTER 503 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH ALPHA(S) = 0.103

| WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) | WAVELENGTH (LAMBDA) | F(LAMBDA) |
|---|---|---|---|---|---|---|---|---|---|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 7.3 | 0.252 | 7.3 | 0.254 | 7.2 | 0.256 | 7.4 | 0.258 | 7.3 |
| 0.260 | 7.2 | 0.262 | 7.0 | 0.264 | 7.0 | 0.266 | 6.9 | 0.268 | 6.9 |
| 0.270 | 6.9 | 0.272 | 6.8 | 0.274 | 6.8 | 0.276 | 6.8 | 0.278 | 6.9 |
| 0.280 | 6.9 | 0.282 | 7.4 | 0.284 | 7.6 | 0.286 | 8.6 | 0.288 | 9.1 |
| 0.290 | 9.8 | 0.292 | 10.5 | 0.294 | 10.7 | 0.296 | 11.2 | 0.298 | 11.0 |
| 0.300 | 10.8 | 0.302 | 10.3 | 0.304 | 9.8 | 0.306 | 9.3 | 0.308 | 8.8 |
| 0.310 | 8.6 | 0.312 | 8.7 | 0.314 | 9.1 | 0.316 | 9.8 | 0.318 | 11.9 |
| 0.320 | 15.2 | 0.322 | 20.9 | 0.324 | 28.9 | 0.326 | 37.9 | 0.328 | 46.8 |
| 0.330 | 54.1 | 0.332 | 60.3 | 0.334 | 64.0 | 0.336 | 66.2 | 0.338 | 68.7 |
| 0.340 | 70.0 | 0.342 | 72.0 | 0.344 | 73.1 | 0.346 | 73.9 | 0.348 | 75.1 |
| 0.350 | 75.7 | 0.352 | 76.8 | 0.354 | 76.8 | 0.356 | 77.5 | 0.358 | 78.6 |
| 0.360 | 79.2 | 0.365 | 80.4 | 0.370 | 81.4 | 0.375 | 82.6 | 0.380 | 83.3 |
| 0.385 | 84.2 | 0.390 | 85.0 | 0.395 | 85.5 | 0.400 | 86.0 | 0.405 | 86.4 |
| 0.410 | 87.1 | 0.415 | 87.3 | 0.420 | 87.6 | 0.425 | 87.9 | 0.430 | 88.5 |
| 0.435 | 88.5 | 0.440 | 89.0 | 0.445 | 89.1 | 0.450 | 89.3 | 0.455 | 89.5 |
| 0.460 | 89.6 | 0.465 | 89.2 | 0.470 | 89.4 | 0.475 | 89.5 | 0.480 | 89.9 |
| 0.485 | 89.9 | 0.490 | 89.9 | 0.495 | 90.3 | 0.500 | 89.9 | 0.505 | 90.7 |
| 0.510 | 90.7 | 0.515 | 90.7 | 0.520 | 90.9 | 0.525 | 91.0 | 0.530 | 91.5 |
| 0.535 | 90.9 | 0.540 | 91.9 | 0.545 | 92.2 | 0.550 | 92.3 | 0.555 | 92.1 |
| 0.560 | 92.3 | 0.565 | 92.5 | 0.570 | 92.8 | 0.575 | 93.0 | 0.580 | 93.0 |
| 0.585 | 93.6 | 0.590 | 93.8 | 0.595 | 93.2 | 0.600 | 93.9 | 0.605 | 93.4 |
| 0.610 | 93.6 | 0.615 | 93.5 | 0.620 | 93.7 | 0.625 | 93.8 | 0.630 | 93.5 |
| 0.635 | 93.7 | 0.640 | 93.7 | 0.645 | 93.6 | 0.650 | 93.4 | 0.655 | 93.8 |
| 0.660 | 93.8 | 0.665 | 93.3 | 0.670 | 93.4 | 0.675 | 94.1 | 0.680 | 93.6 |
| 0.685 | 93.8 | 0.690 | 93.7 | 0.695 | 93.9 | 0.700 | 93.9 | 0.720 | 93.9 |
| 0.740 | 93.8 | 0.760 | 94.0 | 0.780 | 94.0 | 0.800 | 94.3 | 0.820 | 94.4 |
| 0.840 | 94.6 | 0.860 | 94.8 | 0.880 | 94.7 | 0.900 | 94.8 | 0.920 | 94.9 |
| 0.940 | 94.8 | 0.960 | 95.4 | 0.980 | 95.3 | 1.000 | 95.3 | 1.020 | 95.4 |
| 1.040 | 95.2 | 1.060 | 95.5 | 1.080 | 95.5 | 1.100 | 95.6 | 1.120 | 95.5 |
| 1.140 | 95.5 | 1.160 | 95.6 | 1.180 | 95.5 | 1.200 | 95.7 | 1.220 | 95.7 |
| 1.240 | 95.7 | 1.260 | 95.8 | 1.280 | 95.6 | 1.300 | 95.5 | 1.320 | 94.9 |
| 1.340 | 93.4 | 1.360 | 92.9 | 1.380 | 93.8 | 1.400 | 95.2 | 1.420 | 95.8 |
| 1.440 | 95.9 | 1.460 | 96.0 | 1.480 | 96.0 | 1.500 | 96.2 | 1.520 | 96.1 |
| 1.540 | 96.2 | 1.560 | 96.3 | 1.580 | 96.5 | 1.600 | 96.2 | 1.620 | 96.4 |
| 1.640 | 96.4 | 1.660 | 96.4 | 1.680 | 96.5 | 1.700 | 96.2 | 1.720 | 96.3 |
| 1.740 | 96.5 | 1.760 | 96.5 | 1.780 | 96.4 | 1.800 | 96.4 | 1.820 | 96.3 |
| 1.840 | 96.4 | 1.860 | 96.5 | 1.880 | 96.4 | 1.900 | 96.7 | 1.920 | 96.6 |
| 1.940 | 96.7 | 1.960 | 96.5 | 1.980 | 96.5 | 2.000 | 96.4 | 2.020 | 96.2 |
| 2.040 | 96.0 | 2.060 | 95.9 | 2.080 | 95.7 | 2.100 | 95.3 | 2.120 | 94.5 |
| 2.140 | 92.5 | 2.160 | 89.2 | 2.180 | 85.5 | 2.200 | 82.8 | 2.220 | 82.1 |
| 2.240 | 83.5 | 2.260 | 86.1 | 2.280 | 88.8 | 2.300 | 91.3 | 2.320 | 92.8 |
| 2.340 | 93.4 | 2.360 | 93.4 | 2.380 | 93.0 | 2.400 | 92.4 | 2.420 | 91.4 |
| 2.440 | 90.0 | 2.460 | 88.7 | 2.480 | 86.8 | 2.500 | 84.9 | | |

```
APDS CONTROL CARDS AND MESSAGES
JOB=PNTDATA3  ASP #S102
./CALCOMP=APDSCC
100       NLDR21B999  LARRY FOGDALL 655-2954   SPAD PLOTS
110               TP 7TK 800 LDMCC
120               PL CALCOMP STANDARD INK PEN
122               START PLOT # 1   END PLOT # 999
200               STANDARD PAPER
400               1     LARRY FOGDALL                 2=53202R=A1
./END
```