



Conserve O Gram

August 2004

Number 3/10

Supersedes Number 3/10 Dated September 2001

Choosing UV-Filtering Window Films

Introduction

In the past 20 years, the market has become saturated with window films with different performance criteria. Some are designed to reflect sunlight and keep interiors cool. Others strengthen glass and help prevent damage from vandalism. Still others filter various parts of the light spectrum. The films that have been of interest in museums are the so-called “solar” screens that filter part or all ultraviolet (UV) radiation. Unfortunately, not all of the solar films meet museum standards, and the product literature available from the manufacturers is very often confusing and sometimes misleading.

The Electromagnetic Spectrum

To understand how these films perform, you need to know something about the light spectrum itself. Light—both visible and UV—is a very small part of the electromagnetic spectrum, which ranges from cosmic rays on the short-wave end, to radio waves on the long-wave end. All forms of electromagnetic radiation are classified according to wavelengths. Wavelengths are measured in nanometers (nm). A nanometer is one billionth of a meter.

The only part of the light spectrum we can see is the visible segment (between 400 and 760 nm). We are all aware, however, of the harm done by UV radiation. This is the part of the spectrum that we try to eliminate completely

in a museum setting.

The atmosphere filters the shorter end of UV radiation. Window glass filters a bit more, so we are only concerned about the radiation with wavelengths from about 325 to 400nm. Almost any solar film on the market filters to about 380nm. Very few films filter the complete UV spectrum. Most of the product literature for solar films states “98% of UV filtered.” The question is 98% of what? Although not stated in the product literature, most films filter 98% of UV in the range of 325 to 380nm. For a museum, this is not enough.

There is another source for confusion. We don't measure UV in a museum in nanometers but in microwatts per lumen (μ watts/lumen). This is a measure of the proportion (or percentage) of total UV in the light you are measuring.

In the late 1970s, when the standards for museum lighting were first consolidated in *The Museum Environment* by Garry Thomson, the standard was based on the amount of UV radiation put out by an incandescent light bulb. That amount is between 40 and 70 μ watts/lumen, and as a result, the level thought to be acceptable was set at 50 μ watts/lumen. Since that time, technology has improved substantially, and there are light bulbs and filtration methods available that reduce UV to 5-10 μ watts/lumen. This is far below the commonly

accepted and current NPS standard to not allow UV radiation to exceed 50 μ watts per lumen.

How do you find the right film?

Sources for all of the films tested as part of this study are listed at the end of this *Conserve O Gram*. Also check *Tools of the Trade* and Technical Note 4 of the NPS CD-ROM *Exhibit Conservation Guidelines* (Department of Conservation, Harpers Ferry, WV, 1999) to locate suppliers. Be aware that films vary by batch, and that you should always test a sample of the film prior to installation to make sure that it is performing to standard. You can test the film over a window or over a fluorescent lamp. Make sure to block out the light around the film so that the reading from your meter is accurate. (Put the meter directly against the film to make sure that you are not measuring light that isn't being filtered.)

A "Crawford-type" meter that uses a dial only gives a range instead of a specific number of μ watts/lumen. In general, if a film is performing to standard, you won't be able to get a low number reading on a Crawford meter because the film is filtering all of the UV that the meter can read. This means that the film meets museum standards. The newer, electronic meters give a specific number of μ watts/lumen. This figure should be 50 or, preferably, lower.

Evaluation of UV Filtering Films

Museum Management Program (MMP) staff requested film samples from the manufacturers listed at the end of this *Conserve O Gram*. Each film was tested using the above instructions. An Elsec Model 752 UV meter and Gossen Panlux Electronic 2 light meter were

used to take measurements from a MMP office window registering 1200 foot candles of light and 2000 μ watts/lumen of UV without filtration. Results of the readings from the film tests are listed on the chart following.

Other Film Characteristics

In addition to the filtering capability, there are aesthetic choices to consider when selecting films. Some of the films that are effective in controlling UV have metallic surfaces or are very dark colors. These would be inappropriate for a historic structure. Other film characteristics such as shatter resistance may be desirable, but unavailable on films that filter the full range of UV light.

The effects of UV radiation on museum collections can be eliminated with today's technology. Compared to other forms of environmental control and with an effective life of 8-15 years, purchase and installation of UV filtering films on windows and in front of artificial light sources is a relatively inexpensive aspect of collections care.

NOTE: For the long-term preservation of museum objects, you must control the light intensity and duration of light exposure in addition to UV radiation. See *Museum Handbook*, Part I, Chapter 4: Museum Collections Environment, for further information on monitoring and controlling light.

Company Name	Model Number	Visible Light in footcandles (light source measured 1,200 fc)	Ultraviolet light in Microwatts per lumen
ATOFINA	UF3	1000	0
	UF4	1000	0
	UF5	1050	0
Read Plastics	.125OP2	1100	0
	.125OP3	1050	0
Solar Screen	Tscreen 5100	53	250
	Tscreen 5110	120	300
	Energy Screen	550	75-100
	NATTEc1500 Linen 0220	410	120
	NATTEc1500 Bronze 0606	80	300
	MScreen 6003	25	250
	MScreen 6005	40	275-300
	Clear EZ Bond	1100	0
	KoolVue Silver/Silver	350	50
	KoolVue Smoke/Silver	130	350
	KoolVue Bronze/Silver	135	100
	KoolVue Smoke Tint	380	25-50
	KoolVue Green/Green	200	25-50
	KoolVue Blue/Blue	140	50
	KoolVue Smoke/Smoke	100	150
	KoolVue Black/Gold	95	100
	KoolVue Black/Bronze	120	25-50
	KoolVue Bronze/Bronze	145	25
	KoolVue Mauve/Mauve	110	150
	KoolVue Industrial Strength	28	0-25
Sun-Gard Northeast	RLW150E15 DSP SCR	290	75
	RLW150BL15 DPS SCR	190	200
	RLWX150015 DPS SCR	240	100-125
	RLW150B15 DPS SCR	160	150
	NRW200BLACKOUT DPS	1.2	250-300
	NRW100MATTE DPS	1100	125

Sun-Gard Northeast	NRW100WHITE-OUT DPS	750	0-25
	RLW150DN33 DPS SCR	400	100
	RLW150DECORATORNEUTRAL50	510	100
	RLW150DN20 DPS SCR	210	50
	SOLAR 60	700	100
	SOLAR SILVER 35	600	100
	SOLAR 15	360	125
	SIGNATURE 60	750	120
	SIGNATURE 45	550	100
	CENTURY SIGNATURE 35 DPS	460	100
	SIGNATURE 20	260	100
	CENTURY NOVA 35	650	100
	CENTURY NOVA 50	800	100
	CENTURY NOVA 70	280	100
	GGL 12300 C90 PS SCR	1100	75
	GG 700 C90 PS SCR	1100	75
	GG 400 C90 PS SCR	1100	50
	GG 200 C90 PS SCR	1100	100
3M	RE65 NIARL	900	25
	S35NEAR400	500	20
	RE35SIARL	500	25
	LE30CUARL	400	15
	SOLEIL	900	55
	RE20NEARL	230	20
	P-18AR	340	20
	SCLARL400	1100	20
	SCLARL150	800	20
	NV-35	470	18
	NV-15	280	17
	NV-25	450	35
	NV-45	350	25
	RE35NEARL	400	10
ShatterGard	Museum GARD	1000	350
	6 Mil Clear	1100	75
	9 Mil Clear	1100	400
	6-9-12-15 Ml Clear or Tinted	800	70
	15 Ml Clear	1100	400

Madico	SRS-220	340	100
	SRS-330	510	150
	RS-440	600	100
	RS-550	700	100
	NG-20	105	100
	NG-35	490	150
	NG-50	550	100
	SB-221	300	100
	SB-341	550	75
	SB-551	650	100
	SG-220	310	100
	SG-330	440	125
	SG-340	510	100
	SG-550	700	100
	TSG-335	530	25
	TSG-550	570	0
	SDSS-220-X	330	25
	SDS-330-X	510	0
	DBB-200-X	220	75
	RS-220-XSR 4-M	380	50
	RS-440-XSR 4-M	650	50
	SRS-220-XSR 8-M	360	50
	RS-440-XSR 8-M	600	50
	NG-50-XSR 4-M	510	50
	NG-70-XSR 4-M	800	50
	NG-50-XSR 8-M	550	100
	RMS-220-X 2-M	300	50
	MT-200-X-WHITE 2-M	1200	50
	MT-200-X-BRONZE 2-M	320	50
	MT-200-X-GRAY 2-M	270	50
	CLS-200-X	1150	50
	CL-200-X	1150	100
	CL-400-X	1100	175
	LCL-600-XSR	1150	150
CL-700-XSR	1150	150	
LCS-800-XSR	1150	100	
TA-81-XSR	750	75	

Suppliers

Atofina
2000 Market Street
Philadelphia, PA 19103-3222
(215) 419-7000
www.atofinachemicals.com

Read Plastics
12331 Wilkins Avenue
Rockville, Maryland 20852
(301) 881-7900

Solar Screen Corporation
53-11 105th Street
Corona, New York 11368
(800) 347-6527
www.solar-screen.com

Sun-Gard Northeast
82 Mill Plain Road
Danbury, Connecticut 06811
(800) 345-6669
www.sun-gard.com

3M Company
Specified Construction Products Department
3M Center, Building 207-1W-08
St. Paul, Minnesota 55144
(800) 364-3577
www.3m.com

Shattergard
8351 Roswell Road, Suite 196
Atlanta, Georgia 30350
(888) 306-7998
www.shattergard.com

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Revised by the Museum Management Program, 2004.

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The series is distributed to all NPS units and is available to non-NPS institutions and interested individuals on line at <http://www.cr.nps.gov/museum/publications/conservoogram/cons_toc.html>. For further information and guidance concerning any of the topics or procedures addressed in the series, contact NPS Museum Management Program, 1849 C Street NW (2265), Washington, DC 20240; (202) 354-2000.