Let There Be Less Light! A Comparison of Selected Radiation-blocking Window Films

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Introduction

UV radiation has the potential to damage cultural materials. Because daylight has a high UV content, UV filtration is essential. This study explores the following questions:

1. How much do UV-filtering window films reduce visible and UV radiation?
2. How do they modify the spectrum?

Materials & Methods

Equipment

- SoLux MR-16 4700K lamp
- OceanOptics USB2000+ spectrophotometer
- OceanOptics LS-1 tungsten halogen light source
- SpectraSuite software
- Konica Minolta Color Meter II
- ELSEC 764 environmental monitor
- GretagMacbeth white calibration tile
- Glass, film, and adhesive samples

Experimental Set-up†

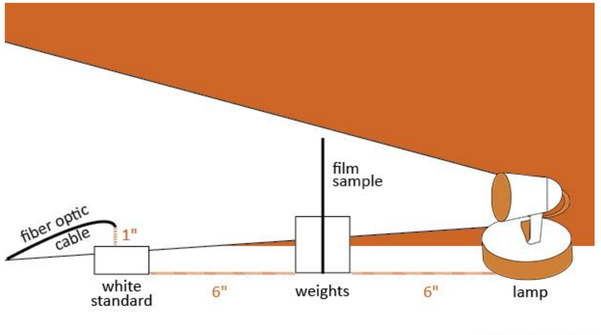


*diagram not to scale

†The diagram shows the set-up to collect spectrophotometer data via the fiber optic cable. The cable and standard were substituted with the Color Meter to measure color temperature, and by the ELSEC 764 to gather data on UV and visible light.

Results

Measured Color Temperature and UV and Visible Light Transmittance

	Product Name	UV Transmittance Provided by Manufacturer (%)	UV Transmittance Measured (%)	Visible Light Transmittance Provided by Manufacturer (%)	Visible Light Transmittance Measured (%)	Correlated Color Temperature Measured (K)§
	Solux MR-16 lamp‡	N/A	100%	N/A	100%	4600 K
UV Filtering Films	Madico UV GARD	<1%	3%	82%	77%	4000 K
	Llumar AU85 UV SR (UVCL - clear)	0.1%	4%	87%	87%	5000 K
	Llumar AIR80 BL SR (clear)	1%	6%	72%	69%	5000 K
Regular commercial films	Madico Nova 70	<1%	28%	69%	66%	4500 K
	Madico Reflective Silver 40	<1%	39%	44%	42%	4800 K
	Llumar N1050 SR	1%	18%	48%	51%	4700 K
	Huper Optik Ceramic 50	0.1%	35%	50%	53%	5000 K
	Huper Optik Ceramic 70	1%	20%	70%	68%	4900 K
	Huper Optik Klar 85	1%	19%	85%	84%	4300 K
	V-Kool 55	1%	11%	58%	54%	4650 K
	V-Kool 65	1%	17%	66%	74%	5100 K
	V-Kool 75	1%	16%	77%	77%	4750 K
Glass and adhesives	Glashutte Lamberts Restauro UV	<0.15%	0%	90%	86%	3700 K
	Saflex Solar SG-41	<0.01%	1%	76%	67%	4600 K
	Saflex XIR laminated 72-41 solar control film	<0%	4%	72%	69%	4400 K
	Saflex RB series, 30 gauge	Not available	13%	Not available	89%	4250 K
	Saflex DG 41	<1%	12%	89%	80%	4300 K

Note: Measured data differs from manufacturer data as it uses a different reference light source and assessment method.

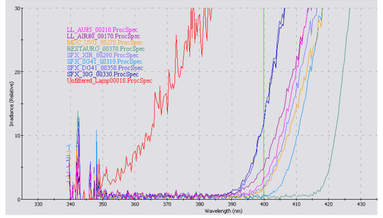
‡The first row of data pertains to the unfiltered lamp.

§An increase in correlated color temperature (CCT) results in a cooler appearance and a decrease results in a warmer appearance.

Spectrophotometer Data

1. Specialty films are designed to filter radiation up to 400 nm, whereas standard UV-filtering films filter up to 380 nm.
2. Restauro UV glass blocks UV radiation and visible light below 430 nm. Since it filters part of the blue/violet range, the transmitted light shifts from 4600 K (the unfiltered lamp) to a warmer color temperature (3700 K).
3. SG-41 is the best of the Saflex adhesives at blocking UV radiation under 400 nm.

Specialty films, Saflex adhesive, and Restauro UV glass.



Key: Unfiltered lamp (red), Llumar AU85 (pink), Llumar AIR80 (purple), Madico UV GARD (orange), Restaruro UV (teal), Saflex SG-41 (bright blue), Saflex DG41 (dark blue), Saflex RB series (darkest blue), Saflex XIR Laminated 72-41 (pale blue).

Conclusion

1. Specially designed UV-blocking films are significantly more effective than regular films.
2. Restauro UV glass is more effective than any of the tested window films.
3. All window treatment options filter visible light.
4. Most treatments have minor correlated color temperature (CCT) shifts; V-Kool 65 has the greatest shift to higher CCT and Restauro UV has the greatest shift to lower CCT.
5. Spectrophotometer data aids in understanding film filtration properties in both the UV and visible range of the spectrum.

Further research is needed to confirm the accuracy of the experimental results, and whether the change in CCT would have a noticeable impact on the appearance of artworks.

Acknowledgements

The authors would like to thank the Andrew W. Mellon Foundation, the Foundation of the American Institute for Conservation, New York University, the Conservation Center of the Institute of Fine Arts, Stephanie Kroll, Alan Puglia and the staff of the Weissman Preservation Center, Margaret Holben Ellis, and Hannelore Römich.

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