Fading

Energy from the sun can be categorized into three regions: ultraviolet (UV), visible (seen by the eye), and near infrared (NIR).

UV light causes the most fading damage. As a result, many people use the classical UV transmission (300 to 380 nm) as an indicator of fading potential to compare glass products. However, visible light can cause fading as well.

A method to quantify the damage from both the combined UV and visible regions was developed by the International Standards Organization (ISO), which uses a weighting function recommended by the International Commission on Illumination (CIE). The result is the ISO-CIE Damage Function.

It should be noted all materials fade at different rates and that no glass choice will completely eliminate fading. All glass options will allow visible light through and therefore cause some level of fading. The way a particular object may fade is highly variable. Some fabrics, woods, paints, inks and other interior finishes are significantly more susceptible to fading.

Manufacturers of interior materials should be consulted for both recommendations and expectations as it relates their products and fading with sunlight and interior lighting.

Cardinal CG manufactures coatings which reduce the potential for fading of fabrics and materials by lowering the UV and visible light transmission. The table on page 2 lists Cardinal's products and their UV Transmission and ISO-CIE Damage Function.

Laminated glass can be used to lower risk of fading further. Even though most laminated glass allows virtually no UV transmission, the visible light that is transmitted will contribute to fading of finishes within a building. In glass constructions where the coating already blocks the vast majority of UV, the addition of the laminate will only provide a small increase in fading protection.

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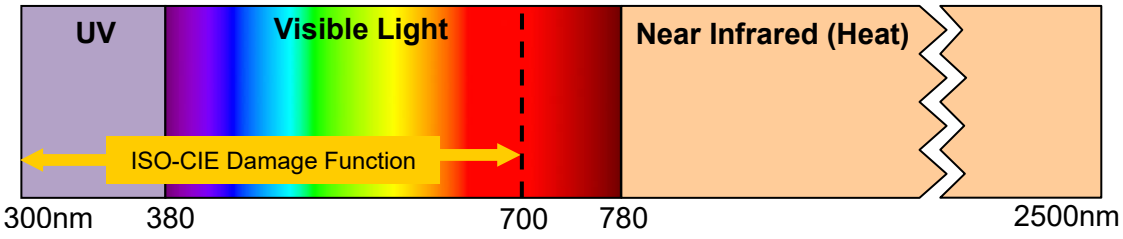
Solar Spectrum in Nanometer (nm) Wavelength



Fading Comparison

		UV Transmission (300 to 380 nm)	ISO-CIE Damage Function (300 to 700 nm)
Monolithic	Clear - 1/8" (3mm)	73%	85%
	7.8L Laminate	<1%	61%
Dual Pane IGU	Clear / Clear	58%	75%
	Clear / LoĒ-180	29%	63%
	Clear / LoĒ-180 ESC	25%	62%
	LoĒ²-272 / Clear	16%	55%
	LoĒ²-270 / Clear	14%	52%
	LoĒ³-366 / Clear	5%	43%
	LoĒ²-240 / Clear	16%	35%
	LoĒ³-340 / Clear	2%	27%
	LoĒ-452+ / Clear	1%	33%
Dual Pane IGU with/ LoĒ-i89®	LoĒ-180 / LoĒ-i89	27%	61%
	LoĒ-180 ESC / LoĒ-i89	24%	60%
	LoĒ²-272 / LoĒ-i89	16%	53%
	LoĒ²-270 / LoĒ-i89	14%	50%
	LoĒ³-366 / LoĒ-i89	5%	42%
	LoĒ²-240 / LoĒ-i89	15%	34%
	LoĒ³-340 / LoĒ-i89	2%	26%
	LoĒ-452+ / LoĒ-i89	1%	32%
Dual Pane IGU with Laminate	Clear / 7.8L Laminate	<1%	55%
	LoĒ-180 / 7.8L Laminate	<1%	51%
	LoĒ-180 ESC / 7.8L Laminate	<1%	51%
	LoĒ²-272 / 7.8L Laminate	<1%	46%
	LoĒ²-270 / 7.8L Laminate	<1%	44%
	LoĒ³-366 / 7.8L Laminate	<1%	39%
	LoĒ²-240 / 7.8L Laminate	<1%	28%
	LoĒ³-340 / 7.8L Laminate	<1%	25%
	LoĒ-452+ / 7.8L Laminate	<1%	31%
Triple Pane IGU	LoĒ-180 / Clear / LoĒ-180	13%	50%
	LoĒ-180 ESC / Clear / LoĒ-180 ESC	10%	49%
	LoĒ²-272 / Clear / LoĒ-180	8%	44%
	LoĒ²-270 / Clear / LoĒ-180	7%	42%
	LoĒ³-366 / Clear / LoĒ-180	2%	36%
	LoĒ²-240 / Clear / LoĒ-180	7%	28%
	LoĒ³-340 / Clear / LoĒ-180	1%	23%
	LoĒ-452+ / Clear / LoĒ-180	<1%	28%

Notes:
(1) Data calculated using LBNL Window computer program per NFRC environmental conditions.
(2) Laminated configuration: 7.8L (3 mm / 0.060" PVB / 3 mm)
(3) Dual Pane: 1/8" (3mm) / ½" (13.0mm) airspace / 1/8" (3mm)
(4) Triple Pane: 1/8" (3mm) / 5/16" (8.0mm) airspace - 1/8" (3mm) / 5/16" (8.0mm) airspace / 1/8" (3mm)