Fading

Energy from the sun can be categorized into three main regions: ultraviolet (UV), visible (seen by the eye), and near infrared (see figure 1). Ultraviolet (UV) energy spans from 300 to 380 nm. Visible light spans from 380 to 780 nm. Near infrared radiation (or heat energy) spans from 780 to 2500 nm. There is more energy below 300 nm, but this is effectively blocked-out by all glass products.

Conventionally, it is considered that UV energy accounts for the majority of fading. As a result, many people use the classical UV transmittance (300 to 380 nm) to indicate fading potential and compare products. It has been shown experimentally fading damage can also occur in the visible light region up to approximately 600 nm (see Figure 1). For this reason, a method to calculate damage weighted transmittance was developed by the International Standards Organization (ISO), which uses a weighting function recommended by the International Commission on Illumination (CIE). This method assigns a specific damage weighted transmittance to each wavelength of UV and Visible light according to its contribution to the fading of materials and fabrics. Its spectral range is from 300 to about 700 nm.

Cardinal manufactures LoĒ® products which reduce the potential for fading of fabrics and materials by blocking out damaging solar radiation. Table 1 lists Cardinal's products and their relationships to the two different fading interpretations: UV, and ISO-CIE.
It is important to consider the sensitivity of the materials or fabrics to be protected. Some materials are only sensitive in the UV region while others display greater sensitivity to the visible spectrum. Knowing the sensitivity of the material to be protected helps determine how well a particular glass product will protect against fading.

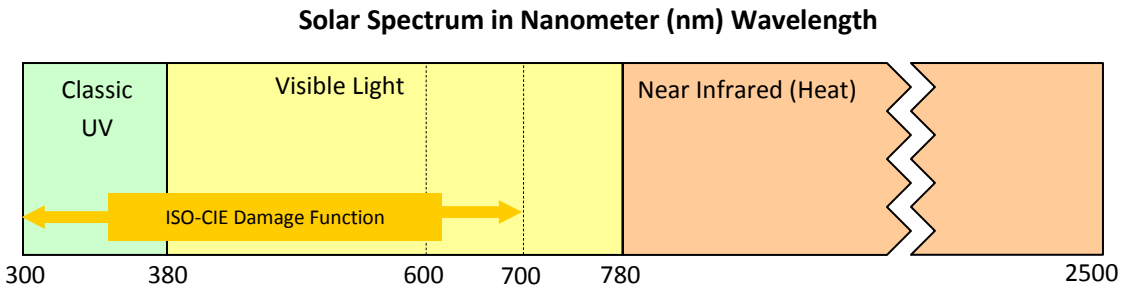

Figure 1

Fading Comparisons

IG Product	UV Transmission (300 to 380 nm)	ISO-CIE Damage Weighted Transmission (300 to 700 nm)
Clear	73%	85%
7.8L Laminate	<1%	61%
Clear / Clear	58%	75%
Clear / LoĒ-180®	29%	63%
LoĒ²-272® / Clear	16%	55%
LoĒ²-270® / Clear	14%	53%
LoĒ³-366® / Clear	5%	43%
LoĒ²-240® / Clear	16%	35%
LoĒ³-340® / Clear	2%	27%
LoĒ-180® / LoĒ-i89®	27%	61%
LoĒ²-272® / LoĒ-i89®	16%	53%
LoĒ²-270® / LoĒ-i89®	14%	51%
LoĒ³-366® / LoĒ-i89®	5%	41%
LoĒ²-240® / LoĒ-i89®	15%	34%
LoĒ³-340® / LoĒ-i89®	2%	26%
Clear / 7.8L Laminate	<1%	55%
LoĒ-180® / 7.8L Laminate	<1%	51%
LoĒ²-272® / 7.8L Laminate	<1%	46%
LoĒ²-270® / 7.8L Laminate	<1%	45%
LoĒ³-366® / 7.8L Laminate	<1%	39%
LoĒ²-240® / 7.8L Laminate	<1%	28%
LoĒ³-340® / 7.8L Laminate	<1%	25%
LoĒ-180® / Clear / LoĒ-180®	13%	50%
LoĒ²-272® / Clear / LoĒ-180®	8%	44%
LoĒ³-366® / Clear / LoĒ-180®	2%	36%

Table 1

Notes:

1. Calculations were conducted using LBNL Window program per NFRC environmental conditions.
2. Monolithic glass thickness is 1/8” (3mm).
3. Laminated configuration: 7.8L (3 mm / 0.060” PVB / 3 mm)
4. Double-Pane IG configuration: 1/8” (3mm) - ½” (13.0mm) airspace - 1/8” (3mm)
5. Triple-Pane IG Configuration: 1/8” (3mm) - 5/16” (8.0mm) airspace - 1/8” (3mm) – 5/16” (8.0mm) airspace – 1/8” (3mm)
6. Coatings on surfaces #2, #3, #4, and/or #5.