Fading Factors

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Glass Manufacturers Emphasize More Valid Measure for Fade Resistance in Window Glass

For decades, the manufacturers of glass and other glazing materials considered ultraviolet (UV) light transmittance to be the ultimate measure of glazing material's ability to protect home furnishings (carpeting, drapes, furniture, etc.) from fading due to normal sunlight exposure.

While it is true that exposure to UV (280 – 380 nm) light is a primary contributor to the fading, it is now known that visible light (380 – 780 nm) is also a significant contributor (as much as 40%) to fading.

The Lawrence Berkeley National Laboratory (LBNL) Windows and Daylighting Group, which provides technical support for more energy-efficient and cost-effective residential windows, warns against using UV transmittance as the sole barometer for measuring potential fading damage. They state: *"Because it (TUV or "Total Ultraviolet Transmittance") is unweighted by a "detector" function, TUV has no correction for the spectral sensitivity of materials to radiation (fading) damage. It doesn't even cover the spectral range in which damage occurs, just the UV, meaning below the visible."*

The LBNL Windows and Daylighting Group goes on to say that TUV is *"believed to have little meaning"* as it relates to fading damage.

As a consequence, new factors that quantify the overall effect of UV and visible light on fading have been developed. The most comprehensive is the ISO Damage Weighted Transmittance (Tdw-ISO), which many experts now use to more accurately assess the potential effects of various glazing materials on fading. This factor quantifies the ability of glass to reduce fading by measuring the effects of both transmitted UV and visible light.

The procedure used to calculate this newer, more comprehensive Damage Weighted Transmittance was developed by the International Standards Organization (ISO)[1] and is based on a weighting function recommended by the International Commission on Illumination (CIE), the world's leading technical organization on lighting and illumination.

Here is how it works:

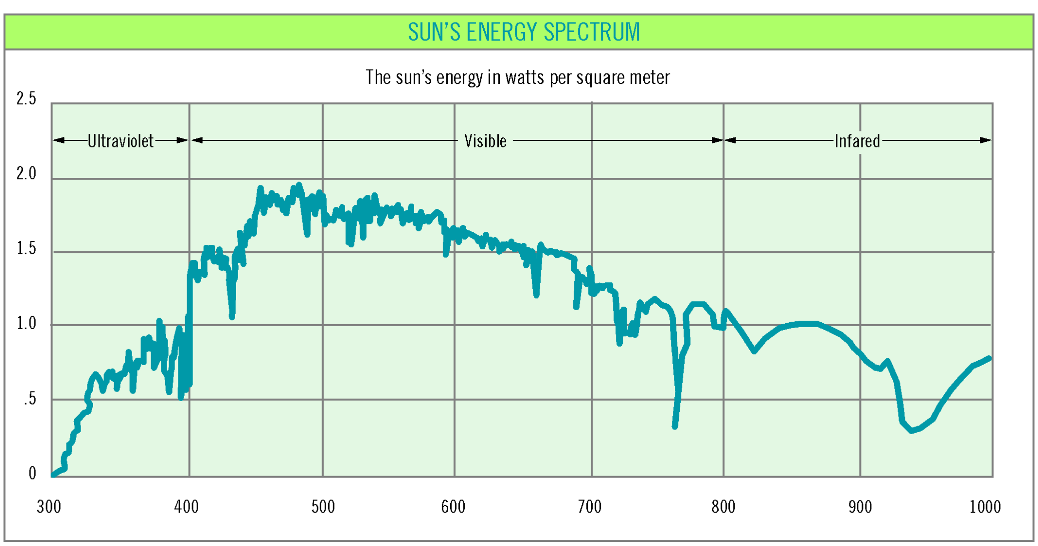
The Solar Spectrum

The sun's energy includes three distinct spectrums, defined according to their wavelengths and typically measured in nanometers (nm).

Ultraviolet (UV) light, which represents only about 3% of the solar spectrum, includes wavelengths from 280 to 380 nanometers.

The visible portion of the spectrum includes wavelengths greater than 380 nanometers to about 780 nanometers.

The Infrared (IR) portion of the spectrum encompasses wavelengths greater than 780 nm and up to approximately 4000 nm. The IR portion of the spectrum is typically associated with heat. While IR does not contribute directly to fading, the heat caused by the absorption of IR radiation can influence the fading process.



Because Tdw-ISO represents damage caused by both UV and visible wavelengths, it is a more accurate tool[1] for assessing potential fade resistance than the total UV transmittance measure that was (and is) traditionally used by many window manufacturers.

Fading Factors

The Tdw-ISO Calculation

The Tdw-ISO calculation[1] assigns a specific Damage Weighted Transmittance to each wavelength of UV or visible light, based on its contribution to fading. It is known that the shorter wavelengths (such as UV) cause more fading damage than the longer wavelengths (such as visible). Consequently, the shorter wavelength will have a higher weighted *"damage"* factor than the longer wavelength. The sum total of these wavelength specific factors yields the Damage Weighted Transmittance for a specific glass product.

By comparing the Damage Weighted Transmittance of various glass types, architects, building owners, home-owners and window manufacturers can more effectively compare their ability to protect interior components from fading.

While Damage Weighted Transmittance is not currently published on most glass manufacturer data sheets, it is available by request. They also can be calculated using the Lawrence Berkeley National Laboratory's Window 5.2 thermal analysis software.[1]

The following chart shows the Damage Weighted Transmit-tance for several PPG glass products in relation to their UV transmittance, as well as the Damage Weighted Transmittance.

As you can see, PPG glass products manufactured with tinted and Low-E coatings have Damage Weighted Transmittance comparable to laminated glasses, which typically have zero UV transmittance. That's because tinted glass and Low-E coatings offer reduced UV transmittance with more protection from the potential damage inflicted by visible light.

Solar Control Low-E and Low-E Glass

Product Description	Visible Light Transmittance (VLT)	Solar Heat Gain Coefficient (SHGC)	Total Ultraviolet Transmittance (UV)	Damage Weighted Transmittance (Tdw-ISO)
Insulated Vision Unit Performance – 3/4" (19mm) units with 1/2" (13mm) airspace and two 1/8" (3mm) lites; interior lite clear				
Clear / Clear	81	0.75	59	0.74
SOLARBAN® 70XL (2) Clear	64	0.27	6	0.43
SOLARBAN® z50 (2) Glass	60	0.35	17	0.48
SOLARBAN® 60 (2) Clear	71	0.39	16	0.56
Insulated Vision Unit Performance – 1-inch (25mm) units with 1/2" (13mm) airspace and two 1/4" (6mm) lites; interior lite clear				
Clear / Clear	79	0.70	50	0.70
SOLARBAN® 70XL (2) *STARPHIRE*®	64	0.27	5	0.43
SOLARBAN® 60 (2) Clear	70	0.38	19	0.54
SOLARBAN® 60 (3) *AZURIA*®	52	0.31	13	0.45
SOLARBAN® z50 (2)	51	0.31	14	0.42
SOLARBAN® 80 (2) Clear	48	0.24	13	0.37

[1] The Lawrence Berkeley Laboratory's (LBL) 5.2 Windows software calculates total weighted damage using two methodologies. The first, Tdw-K, created by German researcher Jurgen Krochmann, covers the UV and visible parts of the spectrum up to 500 nanometers. Tdw-ISO is regarded to provide a more accurate assessment, however, because it includes the visible range up to 700 nanometers. According to the LBL, "Tdw-ISO (TDW) is weighted using a function recommended in the CIE standard which also derives from the work of Krochmann, but is considered to have more general validity."

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PPG Industries, Inc. Glass Business & Discovery Center 400 Guys Run Road Cheswick, PA 15024 1-888-PPG-IDEA www.ppgideascapes.com