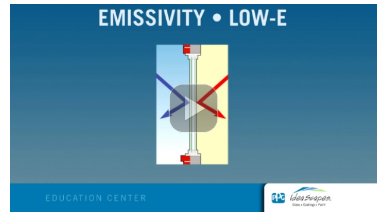
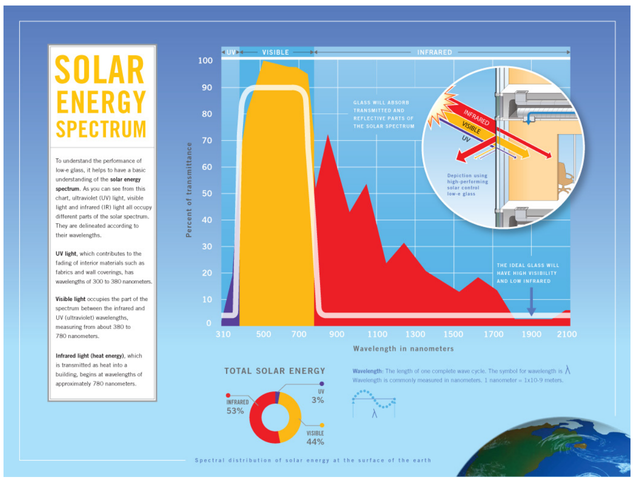
Glass Topics

What is Low-E Glass?



Glass is one of the most popular and versatile building materials used today. One reason is because of its constantly improving solar and thermal performance. And one way this performance is achieved is through the use of passive and solar control low-e coatings. So, what is low-e glass? In this section, we provide you with an in-depth overview of coatings.

In order to understand coatings, it's important to understand the solar energy spectrum or energy from the sun. Ultraviolet (UV) light, visible light and infrared (IR) light all occupy different parts of the solar spectrum – the differences between the three are determined by their wavelengths.

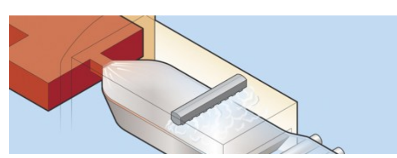


- Ultraviolet light, which is what causes interior materials such as fabrics and wall coverings to fade, has wavelengths of 310-380 nanometers when reporting glass performance.
- Visible light occupies the part of the spectrum between wavelengths from about 380-780 nanometers.
- Infrared light or heat energy, is transmitted as heat into a building, and begins at wavelengths of 780 nanometers. Solar infrared is commonly referred to as short-wave infrared energy, while heat radiating off of warm objects has higher wavelengths than the sun and referred to as long-wave infrared.

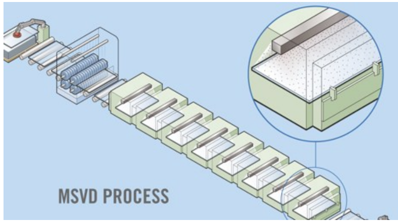
Low-e coatings have been developed to minimize the amount of ultraviolet and infrared light that can pass through glass without compromising the amount of visible light that is transmitted.

When heat or light energy is absorbed by glass it is either shifted away by moving air or reradiated by the glass surface. The ability of a material to radiate energy is known as emissivity. In general, highly reflective materials have a low emissivity and dull darker colored materials have a high emissivity. All materials, including windows, radiate heat in the form of long-wave, infrared energy depending on the emissivity and temperature of their surfaces. Radiant energy is one of the important ways heat transfer occurs with windows. Reducing the emissivity of one or more of the window glass surfaces improves a window's insulating properties. For example, uncoated glass has an emissivity of .84, while PPG's solar control **Solarban 70XL** glass has an emissivity of .02.

This is where low emissivity or low-e glass coatings come into play. Low-e glass has a microscopically thin, transparent coating – it is much thinner than a human hair – that reflects long-wave infrared energy (or heat). Some low-e's also reflect significant amounts of short-wave solar infrared energy. When the interior heat energy tries to escape to the colder outside during the winter, the low-e coating reflects the heat back to the inside, reducing the radiant heat loss through the glass. The reverse happens during the summer time.. To use a simple analogy, low-e glass works the same way a thermos does. A thermos has a silver lining, which reflects the temperature of the drink it contains back in. The temperature is maintained because of the constant reflection that occurs, as well as the insulating benefits that the air space provides between the inner and outer shells of the thermos … similar to an insulating glass unit. Since low-e glass is comprised of extremely thin layers of silver or other low emissivity materials, the same theory applies. The silver low-e coating reflects the interior temperatures back inside, keeping the room warm or cold.



There are actually two different types of low-e coatings: passive low-e coatings and solar control low-e coatings. Most passive low-e coatings, are manufactured using the pyrolytic process – the coating is applied to the glass ribbon while it is being produced on the float line, the coating then "fuses" to the hot glass surface, creating a strong bond, or "hard-coat" that is very durable during fabrication. Finally, the glass is cut into stock sheets of various sizes for shipment to fabricators. Passive low-e coatings are good for very cold climates because they allow some of the sun's short-wave infrared energy to pass through and help heat the building during the winter, but still reflect the interior long-wave heat energy back inside.



Most solar control low-e coatings, such as what are used for Solarban 70XL solar control glass, are manufactured using the MSVD process – the coating is applied off-line to pre-cut glass in a vacuum chamber at room temperature. This coating, sometimes referred to as a "soft-coat," needs to be sealed in an IG or laminated unit and has lower emissivity and superior solar control performance. That being said, the best performing solar control coatings are MSVD and are ideal for mild to hot climates that are more dominated by air conditioning use in commercial buildings.

Low-E coatings are applied to the various surfaces of insulating glass units. In a standard double panel IG there are four potential coating surfaces to which they can be applied: the first (#1) surface faces outdoors, the second (#2) and third (#3) surfaces face each other inside the insulating glass unit and are separated by an airspace and an insulating spacer, and the fourth (#4) surface faces directly indoors.

Whether a low-e coating is considered passive or solar control, they offer improvements in performance numbers. The following are used to measure the

effectiveness of glass with low-e coatings:

- **U-Value** is the rating given to a window based on how much heat loss it allows.
- **Visible Light Transmittance** is a measure of how much light passes through a window.
- **Solar Heat Gain Coefficient** is the fraction of incident solar radiation admitted through a window, both directly transmitted and that is absorbed and re-radiated inward. The lower a window's solar heat gain coefficient, the less solar heat it transmits.
- **Light to Solar Gain** is the ratio between the window's Solar Heat Gain Coefficient (SHGC) and its visible light transmittance (VLT) rating.

Here's how the coatings measure up by minimizing the amount of ultra-violet and infrared light that can pass through glass without compromising the amount of visible light that is transmitted.

Low-E, ½" airspace, ¼" clear	U-Value	VLT	SHGC	LSG
Pyrolytic	0.33 – 0.37	54% – 74%	0.45 – 0.66	1.09 – 1.25
Double-Silver MSVD (High VLT/Low Reflectance)	0.29 – 0.29	53% – 70%	0.28 – 0.39	1.76 – 1.98
Triple-Silver MSVD (High VLT/Low Reflectance)	0.28 – 0.29	61%	0.27 – 0.30	2.17 – 2.37

As a general rule, pyrolytic coatings work well in heating dominated climates, while MSVD is a good fit for cooling dominated climates.

When thinking of windows, size, tint and other aesthetic qualities come to mind, but low-e coatings play an important role in the overall performance of a window and can significantly affect the overall heating, lighting, and cooling costs of a building.

For complete technical information about designing with low-e glass, read **PPG Glass Technical Document TD-131**. And for any other glass questions, please **contact PPG** or call 888.PPGIDEA (888.774.4332).