Technical Information

APPEARANCE OF INSTALLED
Pilkington Energy Advantage™ Low-E Glass
AND
Pilkington Solar E™ Solar Control Low-E Glass

The low emissivity property of Pilkington Energy Advantage Low-E and Pilkington Solar E Solar Control Low-E Glass pyrolitic coatings is obtained by growing - with a chemical vapor deposition (CVD) process - a polycrystalline layer of tin oxide over color suppression underlayers (including a solar control layer in the case of Pilkington Solar E glass). In an electron microscope picture, the polycrystalline structure of the surface of the tin oxide top coat can be seen as a layer of closely packed grains. Daylight can easily pass, with less than 1% alteration, through this coating because each grain is actually smaller than the wavelength of visible light. The illustration below shows the surface of the coating magnified 20,000 times.

![Typical grain structure, magnified 20,000 times.](image)

The extremely small size of the grains makes them invisible in most lighting conditions.

The following electron microscope image shows a cross-section through a Pilkington Energy Advantage Low-E glass coating. The polycrystalline nature of the coating contrasts with the non-crystalline ‘super-cooled liquid’ nature of the solid glass underneath the coating.
It is possible to discern the presence of the coating under certain lighting conditions, such as when bright sunlight shines directly on partly shaded, Low-E coated glass. When looking out through the glass towards a dark shaded background the short wavelength component (blue) of the sunlight appears slightly scattered. This gives the coating a uniform very faint blue appearance visible in the sunlit area. Longer wavelength red light is less scattered. It is made more noticeable by the lack of visible haze in any contrasting shaded areas, such as in the diagonal shadow in the photo below.

The amount of scattering is continually measured and controlled during production. The amount of haze or scattered light is normally 0.5% of the incident visible light. For reference, a car windshield after 60,000 miles normal driving on paved roads can have ten times as much (5.0%) scattering of light (haze). It is this tin oxide coating which gives the low emittance property to the glass and controls heat flow through the glass by reflecting, and reducing the emittance of infrared energy.
Haze only becomes visible when its brightness is significant relative to that of the images viewed through the glass at the same time. The worst case is when 0.5% of the sun’s light (say 10,000 lumens), = 50 lumens, is scattered when the sun is shining almost directly into the viewer’s eye. This could be easily noticed when compared to the dim light coming from a deeply shaded area, say about 1/1000 as bright as sunlight or 10 lumens. It should be noted that the light scattering (haze) from normal dirt, on an average plain window before cleaning, is around 1% to 2% and so it is even more visible in the worst case lighting condition described above.

For typical lighting on most Low-E coated windows, and for the greater part of the day, there will be no haze visible. The photo below shows no haze in the sunlit Pilkington Low-E glass, when there is no deep shade beyond the glass.

Before a light of Low-E coated glass is glazed into a frame, sunlight, or a bright light, shining directly onto the glass cut edge can internally reflect within the body of the glass and produce a series of faint parallel lines a few inches from the glass edge where some reflected light is scattered by the coating. The photo below shows these lines. They are more visible on the left hand side of the glass where there is a dark background behind the glass.
Fig. 3. Temporary or Transient Lines caused by sunlight on an exposed glass edge

This effect completely disappears when the glass edges are shaded by being glazed into a normal sash or frame.

An alternate way to achieve the very high thermal insulation provided by the hard Low-E coating in a double glazed unit, is to use a ‘soft’ sputtered coating produced off-line in a vacuum chamber. Such coatings must be protected from humidity by being sealed into an IG unit. The sputtered coating is typically removed or ground off at the perimeter to allow effective insulating glass sealant adhesion. The sputter coatings usually have some reflected color.

Sputter coat IG reflected color of a grey sky. The same sky reflected in clear glass IG.
Viewed in transmission, in the photo below, the top IG unit is sputter coated low-e, the lower left is a Pilkington Low-E IG, and the lower right is a clear glass (no coatings) IG unit.

The use of three lites of plain glass in a triple glazed unit can also give insulation values similar to a double glazed unit with a Low-E coating. But this involves a thicker and heavier window unit, with increased reflectivity, and more distortion in the reflected images when weather changes cause greater expansion and contraction of the wider total air space. There is an increased risk of breakage with improperly balanced air spaces, compared to sealed double glazing.
Please call Architectural Technical Services directly at (419) 247-4448 if you need any further information.

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