LOW-EMISSIVITY GLASS COATINGS EXPLAINED

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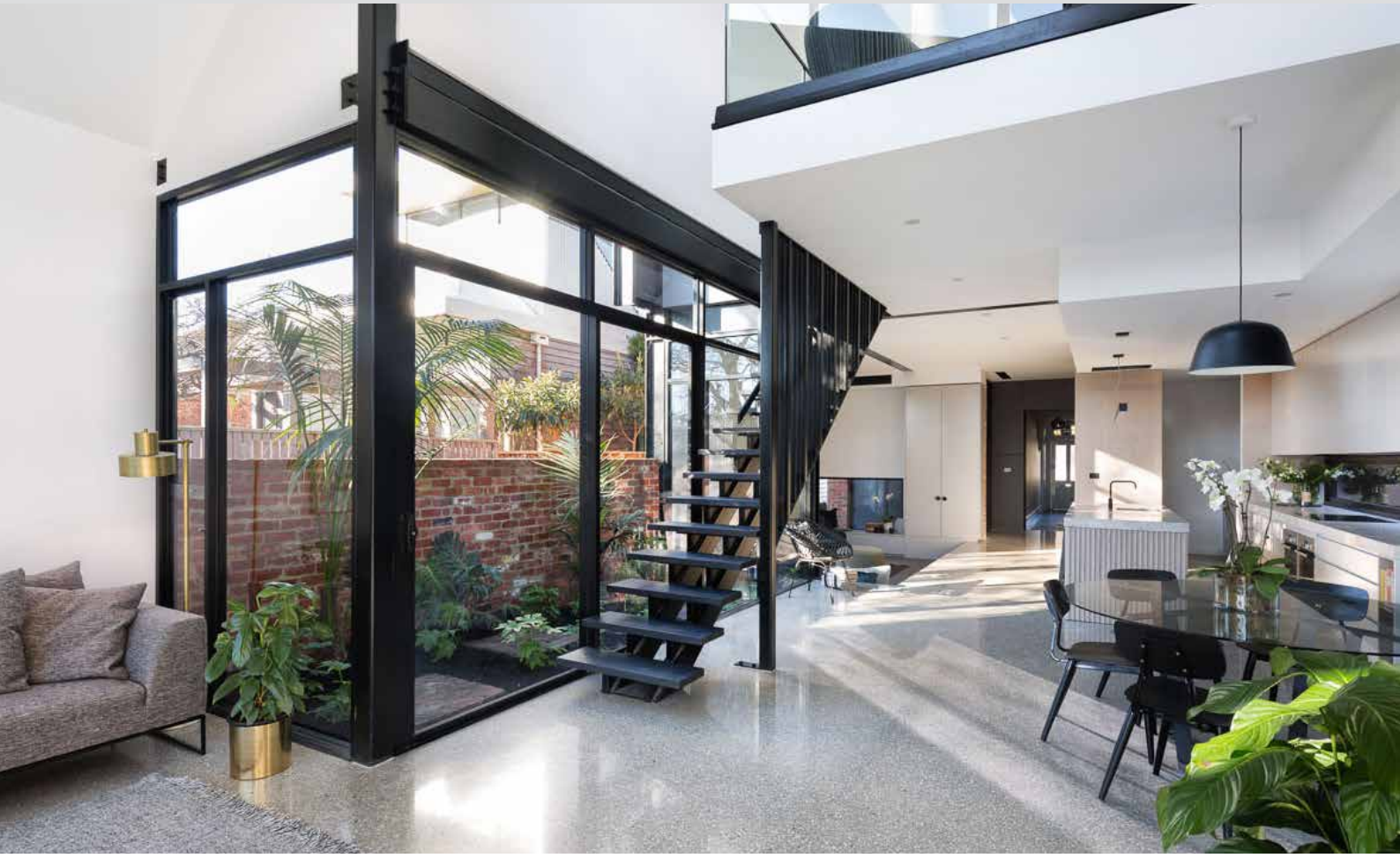
INTRODUCTION

Low-emissivity (low-E) glass comes in so many variations to suit different budgets and window performance requirements that it can be difficult to get your head around at times. Then there are different types of coatings with different glazing requirements and performance factors within the low-E space. Australian glass processor Glassworks (Aust.) provides a rundown of the main coatings and glazing options that best suit Australian conditions.

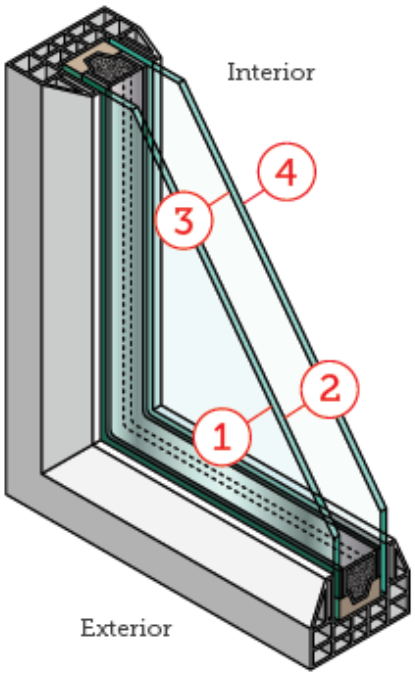


UNDERSTANDING THE TYPES OF COATINGS

Low-emissivity coatings essentially work by interacting with radiation in the two regions that windows are exposed to. The first being the solar region (short wavelength radiation emitted from sun) and the other being the room temperature region (long wavelength radiation).

The two main coating categories are Magnetron Sputtered Coating and Pyrolytic Coating. The main difference between the two is that the low-E Magnetron Sputtered Coating (also known as a Soft Coat or Sputter Coat) is designed to go inside the unit and therefore double-glazed in an Insulated Glass Unit (IGU). This type of coating cannot be exposed and generally performs better than Pyrolytic in terms of solar control and the reduction of heat transfer through the window (low U-Value).

Pyrolytic Coatings (also known as Hard Coat or Room Side Coat), on the other hand, are tough enough to be exposed and can be left monolithic (single glazed), although they perform better when double-glazed. These coatings generally offer less solar control as they are designed to reflect indoor heat from back inside the room, lowering the U-Value.



Designation of IGU glass surfaces. Low-E coatings can only be applied to Surfaces 2, 3 or 4.

> “A low SHGC with a high VLT means the light comes in while reducing heat from the sun at the same time.”

INTERPRETING THEIR PERFORMANCE

Within these main coating categories are different options to best suit different climates, building elevations, and environmental requirements. Many are designed to slow heat transfer and maintain a near constant internal temperature, thereby reducing air-conditioning loads. Others minimise heat loss and capitalise on the winter sun in order to reduce heating loads, while some even balance both. What the building is battling with – glare, heat gain, cold, or extreme temperature fluctuations – dictates the most suitable low-E unit.

The best way to tell is from the Visible Light Transmission (VLT), U-Value, and Solar Heat Gain Coefficient (SHGC) scores. VLT is self-explanatory; U-Value expresses the heat transfer rates while SHGC is the total amount of energy from the sun getting through the window. The lower the U-Value, the better the insulation, and the lower the SHGC the more effective the window is at blocking energy from the sun. On the other hand, higher SHGCs are more effective at collecting solar heat during the winter (passive solar).

General Manager of Glassworks, Michael Gleeson, advises to look out for the VLT versus SHGC. He explains that a low SHGC with a high VLT means the light comes in while reducing heat from the sun at the same time. “Although it should be the building’s climate, orientation, and external shading which determine the optimal SHGC for a window, door, or skylight,” Michael explains.

HOW THE DIFFERENT COATINGS WORK

Given the complexity of the different coatings in various possible combinations in an IGU, it is handy to know how the low-E coatings work and how they should be glazed to ensure they perform exactly as intended.

1. LOW-E MAGNETRON SPUTTERED COATINGS

As a magnetron coating must go inside the unit, it is always incorporated into an IGU on surface 2 or 3. For the warmer climates that are common in Australia, the coating should go on the surface facing the outside pane (surface 2) so it can absorb solar radiation and reflect it back outside. In less common colder climates, it may go on the surface facing the room (surface 3) so it can absorb the heat and reradiate it back inside. Most magnetron coated low-E’s perform better and give a better appearance when coated on surface 2 rather than surface 3. However, this is not a common requirement in Australia. The exception to this would be a super clear low-E magnetron coating like Viridian Lightbridge™ or Pilkington Optitherm®, which can be coated on surface 2 or 3, depending on the climate.

Other examples of traditional low-E magnetron sputtered coatings are Viridian PerformaTech™, Vitro Solarban® 70, Guardian SunGuard® SNX, and Cardinal LoE^3-366® and LoE^3-340® processed by Glassworks in Australia - with the little ‘3’ referring to an invisible triple layer of silver. These coatings are each specially designed to perform in different conditions with a common benefit of excellent thermal control.

Talking specifically about how some of Glassworks’ products differ, Michael explains that Optitherm is a clearer low-E with great visibility and insulation, while LoE^3-366 is designed to balance thermal control and visibility in hot and cold climates and is therefore suited for both residential and commercial windows where temperatures fluctuate. He describes LoE^3-340 as a solar-blocking low-E for commercial buildings battling with heat gain. “As it achieves a Solar Heat Gain figure of just 0.18, LoE-340 can be used for western elevations without blinds or overhangs,” Michael adds.

2. LOW-E PYROLYTIC COATINGS

Pyrolytic Coatings (also known as Hard Coat or Room Side Coat) are a single layer vapour deposit that is fired on at high temperatures during the float glass process and is tough enough to be exposed internally and used on surface 2 of a monolithic window or surface 4 of a double glazed IGU. In spite of this, it is not a room-side only coating, as it too can be incorporated in an IGU on surface 2 or 3 – even performing far better this way. The best-known examples of Pyrolitic Coatings are Viridian EnergyTech™, Pilkington Energy Advantage™, and AGC Planibel G.

The advantages of a Pyrolytic Coating are that it is more durable, versatile, and easy to handle, with the disadvantages being that it offers less solar control on clear glass than many low-E Magnetron Coatings and has a higher comparative U-Value when in an IGU.

One exception of a low-E coating tough enough to be exposed is an Indium Tin Oxide Coating (ITO). An ITO is technically a magnetron sputtered coating but as it is not silver based like other low-E Magnetron Coatings, it too can go on the interior surface of a window (surface 2). This means that it does not necessarily have to be double-glazed, even though it performs better as a double glazed unit and better still when combined with other Low-E magnetron coatings on surface 2 of an IGU.

An example of this is Cardinal LoE-i89, which is processed locally by Glassworks. Michael states that because sputtered coatings are generally thinner and smoother they are often clearer. “We specifically introduced LoE-i89 to the Australian market to fulfil this need for a high performing single glazed clear product without the haze,” he says.

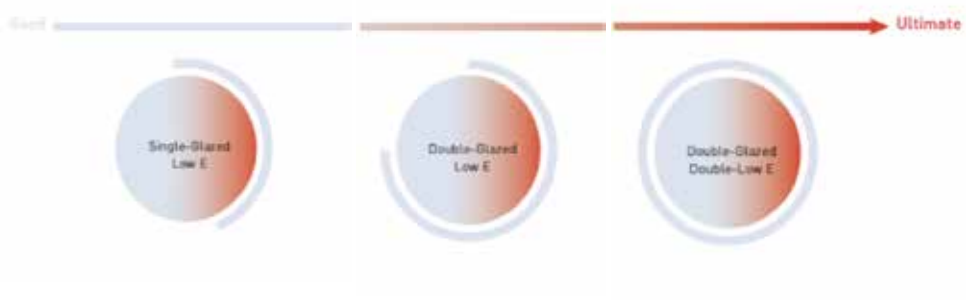
RECOMMENDED IGU COMBINATIONS

In essence, to ensure a building performs at its absolute peak, a monolithic option is not recommended, although it can be a good entry-level option if the client's budget is limited.

However, to achieve superior window performance, a combination of a room side coating on surface 4 and the best sputtered Low-E coating on surface 2 of a double glazed IGU should be used. Combining LoE^3-366 and LoE-i89 in such a makeup - 6mm LoE-366/12mm Argon/6mm LoE-i89 - results in a VLT of 63%, an SHGC of 0.27, and an unprecedented U Factor of 1.1, and is therefore highly recommended for western elevations or windows generally receiving the most sun.

A "good, better, ultimate" scenario could look something like this. The "good" would be a monolithic pyrolytic or ITO low-E, the "better" would be a double glazed IGU with a low-E magnetron sputter coating on surface 2 or 3, and the "ultimate" would be a double glazed IGU with a low-E magnetron sputter coating on surface 2 plus a low-E pyrolytic or ITO coating on surface 4.

Another option to lower the overall project cost without severely impacting performance is to pick and choose which windows warrant the added expense of the best IGU combination and which are protected by shade and less likely to need it.



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