LOW-EMISSIVITY GLASS

This new series of articles will look at aspects of the thermal performance of residential window systems including a variety of glass and glazing types, framing and the effect of climate. First up is low-emissivity glass.

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Low-emissivity (low-E) glass is a type of glass that has a specialised coating that is able to affect the transfer of heat through a glazing system.

Heat is transferred through glazing by:

- conduction
- convection
- radiation.

Standard clear double glazing reduces heat travelling by conduction and convection – the majority of heat flow. However, it does little to reduce the small percentage of heat that is transferred by radiation. This is where a low-E surface assists.

Comparing R-values

A low-E surface can improve the window R-value to about:

- 0.31 m^2K/W from 0.26 m^2K/W for standard double glazing in an aluminium frame
- 0.20 m^2K/W from 0.15 m^2K/W for single glazing.

Table 1: Typical thermal performance of a whole window with the selected glazing system (from NZS 4218:2009).

Window system	Window R-value (m^2K/W)
Aluminium framed, clear single glazing	0.15
Aluminium framed, low-E single glazing	0.20
Aluminium framed, clear double glazing	0.26
Aluminium framed, low-E double glazing	0.31

Table 1 shows the typical thermal performance for these window systems in an aluminium frame, as extracted from NZS 4218:2009 *Thermal insulation – Housing and small buildings.*

Which surface has the coating?

The low-E surface can technically be on any of the two surfaces of single glazing or on any of the four glass surfaces of double glazing. The location of the coating does not affect the R-value, but it does affect the durability of the coating and the solar heat gain coefficient (SHGC).

In New Zealand, the low-E coating is usually placed on the outside facing surface of the inner pane in double glazing. This protects the surface and maximises the passive solar gains in winter but slightly reduces the ability to control summer heat gain (see Figure 1).

Different types of coatings

There are two common types of low-E glass coatings – soft coat (sputter-coated) and hard coat (pyrolytic).

SPUTTER-COATING

Sputter-coating is applied after glass has been manufactured by depositing a thin metallic coating onto the glass surface in a vacuum chamber. As the coating is not fused into the glass surface, it is susceptible to damage by oxidation or by scratching.

Sputter-coated glass is not recommended for single glazing. It should only be used in insulated glass units with the coating facing towards the inside of the units.

PYROLYTIC COATING

Pyrolytic coating is applied during the manufacture of glass by bonding a metallic coating to the glass while it is in a semi-molten state. The metallic coating becomes part of the glass surface, rather than being an additional layer, making the coating more durable.

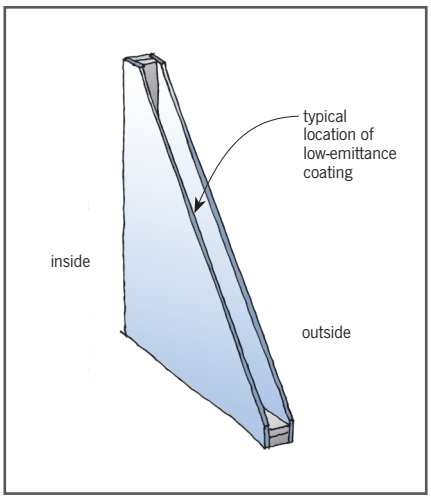

Figure 1: Double glazing unit (cutaway).

Along with use in double glazing, in specific conditions, pyrolitic low-E glass can be used as single glazing with the low-E coating on the inside of the building. This will provide a window R-value of around 0.2 m^2K/W, part way between the R-value of a window with normal single clear glass (0.15 m^2K/W) and double glazing (0.26 m^2K/W) in a typical aluminium frame.

Normal cleaning will not damage or scratch the pyrolytic coating, but use of abrasive cleaners or rough handling may cause damage. The hard low-E coating is rougher than uncoated glass, which can cause objects dragged along its surface to leave a visible deposit that looks like a scratch. The mark is usually only a deposit from the object and can normally be removed

with an appropriate solvent or cleaning solution (refer to the manufacturer for the appropriate product).

Condensation reduces effectiveness

In a cold climate or where there is high indoor humidity, condensation occurs more readily on the cooler coated surface of single low-E glass than on the uncoated surface of single glazing. Condensation reduces the effect of the low-emissivity surface – a pane totally covered with condensation will be ineffective and have the R-value of normal glass.

Where condensation is likely to occur on the inside of glazing, always use insulated glass units rather than single-glazed low-E panes.

Place for single-glazed hard-coat low-E

Although double glazing provides better thermal performance than single-glazed hard-coat low-E panes, there are occasions where double glazing is not practicable.

In timber doors, for example, single-glazed low-E panes might be the only option to improve thermal performance, or they may be the only option when renovating older aluminium windows that do not have enough sash width to fit double glazing. In this case, designers should work closely with professional glass companies when deciding between single-glazed hard-coat low-E glass and insulated glass units.

Soft-coat low-E products should never be used in single glazing.

The next article will look at some other glass performance issues and explain the solar heat gain coefficient (SHGC).