AUSTRALIAN GLASS & WINDOW ASSOCIATION

TECHNICAL FACT SHEET: GLASS STAINING

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Introduction

The popularity of glass as a building material is due to its unique range of properties. It is transparent, providing valuable light into our buildings, very hard (Mohs scale 5.5) and it is also easy to clean.

Many people are surprised to learn that glass can be stained. Glass staining is more correctly glass corrosion and this document uses the terms interchangeably.

Glass staining is a relatively uncommon occurrence that only occurs under a specific set of circumstances. These circumstances can occur in the manufacturing / processing environment but can also be found elsewhere.

Glass should always be stored under cover and if protected on building sites by film, care needs to be taken to ensure moisture is not present between the glass and the film. If storing glass under tarps or plastic sheeting consideration should also be given to the possibility of condensation forming and wetting tightly packed glass.

At its most basic, the conditions required for glass staining to occur are tightly packed glass and moisture. An exception to this occurs in insulated glass units (IGU's) that have suffered seal failure. In this case the moisture trapped inside the cavity can also trigger corrosion.

Glass staining is a two stage process. While the results of Stage 1 staining are normally only visible due to further processing of the stained glass, eg during glass coating, Stage 1 provides the environmental conditions required for Stage 2 corrosion which can be seen with the naked eye.

Stage 1 - Corrosion

When water gets between two pieces of tightly packed glass, the small gap between the glass means that a small amount of water is squeezed over a much larger area than would normally occur.

It also does not have the opportunity to evaporate. A similar situation exists when wet glass is left in contact with a storage rack or processing equipment for a period of time.

The water on the glass surface leeches sodium ions from glass through a process known as "diffusion controlled ionexchange". While the details of that process are outside the scope of this document, the results of it are not. The sodium ions lead to an increase in the pH levels of the water making the water more alkaline. When the pH levels of the water get to 9.0, Stage 2 corrosion begins.

The effects of Stage 1 corrosion are not normally visible to the naked eye but its effect may be seen in subsequent processing, particularly low e or reflective coatings. (This is one reason that "fresh" glass is so important for glass coating.)

Stage 2 - Corrosion

In Stage 2 corrosion, the silicon – oxygen bonds are broken. In short, the surface of the glass is dissolved and visible staining occurs. The microscopic pitting of the glass surface manifests itself as iridescence (rainbow stain) or as a dense translucent haze. The only way to remove the stain is to re-polish the glass surface by using an abrasive such as cerium oxide. This is often a difficult and time consuming process and many cases replacement is the preferred option.

It should be noted that glass corrosion occurs on the microscopic level and does not affect the glass strength.

Further reading

Pilkington Architectural Technical Bulletins www.pilkington.com

PPG Industries Technical Library www.ppg.com

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