Architectural Technical Applications Center

Sealant Compatibility Testing – Laminated glass with Saflex® interlayers

Saflex® and Vanceva® brands of polyvinyl butyral (PVB) interlayer are plasticized interlayer films that are laminated between two or more plies of glass. The PVB interlayer can react with non compatible materials with which it may come in contact. As such, direct contact between Saflex and/or Vanceva PVB interlayers with chemicals used in sealants or adhesives should be carefully examined and in some cases avoided.

Compatibility testing is conducted between commercially available sealants and our Saflex and Vanceva brand interlayers as warranted by product introductions or modifications. We are not able to test every sealant on the market, due to space and resource constraints, however we do concentrate on commonly used families of sealants from major manufacturers.

Results are reported from the testing, but we do not make sealant recommendations as we can not and do not control variations and modifications in the sealants we test. Our tests are also performed under a strict protocol so that comparisons can be made between products tested, but may not reflect actual performance as installed.

We have not found a commercially available sealant that is consistently compatible with the laminated glass as tested under our conditions. Based on our experience and testing of several silicone based sealants, those sealants that contain acetic acid tend to have the highest amount of edge effects when they are in intimate contact with the interlayer at the edge of the sample.

Sealants and other adhesives are tested for edge effects with laminated glass made with Saflex and Vanceva interlayers in accordance with the procedures documented below. The sealants and adhesives are made available to Eastman by suppliers, fabricators and manufacturers. Eastman makes no recommendation, either direct or implied, as to the usefulness of this data and states that it is applicable for the materials received and as tested. The data is presented for the informed use of the glazing industry. The results of the testing are periodically reported and updated on the website www.Saflex.com.

Edge effects are normally seen as clear, very small, 2 mm – 12 mm (0.08 in – 0.50 in), edge bubbles, sometime continuous along an edge, other times very distinct and isolated depending upon the sealant or adhesive. Edge effects from sealants and adhesives are typically maximized in depth at approximately 10 mm (0.39 in) from the edge. Although a slight discoloration can occur with sulfide containing sealants and adhesives, normally the edge effect is clear.

Sealants may contain solvents that can be harmful to the interlayer edge. In most cases investigated, the sealants considered neutral in curing are routinely better performers in a compatibility assessment than those sealants that have acids (i.e.: acetic acid).

Occasionally a test cycle will result in minimal to no interaction between the laminate and the sealant or adhesive under the controlled test environment. This does not guarantee the same results in field as application, environmental and material deviations can occur.

730 Worcester Street | Springfield, MA 01151
413.730.3413 | jcschi@eastman.com

Sealants, adhesives, gaskets and setting blocks should be selected firstly on a basis for their desired performance (i.e.: compression, tensile strength, weatherproofing, structural, cosmetic), with edge effects being a consideration after a performance class or family has been established.

For additional information about the chemical nature of Saflex brand PVB, refer to the Material Safety Data Sheet (MSDS) or the website www.saflex.com.

Test Procedure

This test method is a laboratory screening procedure for determining the compatibility of elastomeric glazing sealants when in contact with the laminated glass edge after exposure to heat, humidity and ultraviolet light.

This test method requires the sealant to be in intimate contact with the edge of the laminated glass having the most direct access to the interlayer throughout the test duration.

This test method does not include assessment of the sealant or glazing tape itself or the sustainability of sealant properties through the exposure.

This test method includes the observation of two parameters as follows:

Changes in color of the interlayer, and

Changes in the glass to interlayer interface as depicted by bubbles, let-goes or other visual anomalies at the edge.

This test method may be conducted in accelerated exposure and/or natural exposure according to the procedures outlined.

This test method is applicable for any liquid sealant, one or more parts, that can be tooled into intimate contact with the laminate edge.

This test method is applicable to glazing tapes that are capable of achieving and maintaining intimate contact with the laminate edge throughout the test duration.

Flat laminated glass panels have sealant or glazing tape applied to the edges of the unit ensuring intimate contact between the sealant and the laminated glass edge with the sealant or glazing tape having the most direct exposure to the interlayer.

Sealants are allowed to cure at room temperature 21°C ± 5°.

Visual ratings are reported at predetermined intervals and/or at the completion of the exposure program which include: maximum depth of edge effects, average depth, average area, the presence of a plateau and any discoloration.

Significance and Use

In most installations where the sealant is used as a weather seal, the sealant material rarely comes into contact with the laminated glass edge. In butt joint glazing, structural glazing, some point fixed glazing systems, installations where a heel or toe bead is applied, and in sealed insulated glass units, the sealant could come into contact with the edge of the laminated glass and potentially with the interlayer. Reactions between the sealant, glazing tapes and interlayer may occur and could cause a visual anomaly. This test method purports to outline a standardized test method to evaluate the formation and severity of such visual edge effects.

Apparatus

Natural exposure shall consist of samples being placed at an exposure site near Miami, FL in accordance with ASTM D1435 using a 26° North latitude; 45° angle facing South

Accelerated exposure shall be conducted in a chamber capable of maintaining the temperature, condensation and light and dark cycles outlined in section 11 with a radiation source of UVB 313 bulbs.

Sampling, Test Specimens, and Test Units

Sampling: Laminates and sealants shall be prepared from materials within accepted manufacturing targets and typical of commercial production.

Test Specimens: A minimum of two identical specimens for each type shall be used.

Specimen Size: Each specimen shall be a minimum of 52 mm (2 inches) wide and have a minimum of two continuous edges which are 305 mm (12 inches) in length

Test Units consist of the glass and interlayer permanently bonded together with sealant or glazing tape in intimate contact with the laminate edge. No voids or bubbles are allowed between the sealant or glazing tape and the laminate edge.

Laminates without sealant or tape shall also be exposed as controls.

Preparation of Apparatus

Natural exposure – racks shall be clean and free of interfering contaminates. Adequate anchorage shall be in place for each laminate. Anchorage shall not interfere with the weathering or rating of samples.

Calibration and Standardization

Accelerated weathering apparatus shall be calibrated to ensure temperature targets and tolerances are met and maintained throughout exposure period.

Exposure

Natural exposure shall be for 2.5 years at an Exposure site near Miami, FL in accordance with ASTM D1435 using a 26° North latitude; 45° angle facing South

Accelerated exposure shall be for 3500 hours and shall be conducted in a chamber capable of maintaining the temperature, condensation and light and dark cycles in accordance with section 11.2.1. Conditions shall repeat uninterrupted between rating frequencies until 3500 total hours are met.

730 Worcester Street | Springfield, MA 01151
413.730.3413 | jcschi@eastman.com

Exposure Conditions. Radiation Source shall be UVB 313 Bulbs. Test Cycle and Temperature: 16 hours of UV (no condensation) at 66° C immediately followed by 8 hours of condensation (no UV light) at 60°C.

Procedure

Laminated glass to be prepared in manner typical for product type and according to manufacturer's instructions.

Flush trim or manufacture laminated glass edges to ensure no interlayer protrudes beyond glass.

Laminate glass edges shall be cleaned with white spirits and a clean soft cloth. A two (2) cloth method is to be used whereas the first cloth, slightly dampened with spirits is rubbed along the edge to remove any residue or contaminate present. The second soft clean cloth is to be used to immediately wipe the edge dry of any persisting spirits. No standing solvents shall be left on the laminate edges.

A laminate with no sealant or glazing tape applied (bare edge) is placed in each exposure unit to serve as a laminate control.

Liquid applied sealants

Cover the laminate faces with masking tape aligning the edge of the tape with the edge of the glass. No overlap of the tape is permitted over or onto the laminate edge.

Prepare a flat surface with a material that prohibits the adhesion of the sealants or tape (such as polyethylene sheeting) to allow for easy release and removal of laminate systems after sealant or tape application and curing. The removal of the laminate from the surface must not disturb or adversely affect the bond between the sealant and/or tape and the laminate.

For liquid sealants, sample dividers covered with a material to allow easy release of sealants are prepared at the same nominal thickness as the laminates being tested. Sample dividers serve as spacing guides along the 305 mm (12 inch) laminate edge for consistent dimensional application of sealants to the laminate edge.

Sample dividers are secured to the protected flat surface to prevent movement and skewing during sealant application and curing. The dividers are situated to allow uniform 12 mm ± 3 mm (0.50 inch ± 0.125 inch) cavities on either side of the laminate.

Laminates are placed and secured with double faced tape or equivalent method between the secured spacers ensuring maintenance of the 12 mm ± 3 mm (0.50 inch ± 0.125 inch) cavities.

Sealants are caulked or introduced into the cavities in a manner to avoid the formation of voids and ensure intimate contact with the complete 305 mm (12 inch) edges.

Tool and remove excess sealant from the samples.

Specimens shall remain undisturbed for a minimum of 21 days at 21°C ±2°C (70°F ±4°F) at 50%± 5% Relative Humidity prior to placement in exposure.

The removal of the laminate from the surface and dividers must not disturb or adversely affect the bond between the sealant and/or tape and the laminate.

Protective tape from the surfaces of the laminates is removed after curing. Clean edges between the laminate edges and the sealant or tape should be visible to facilitate rating of any edge effects. Additional cleaning of the glass surface may be conducted if there is bleed through which may inhibit the rating of edge effects.

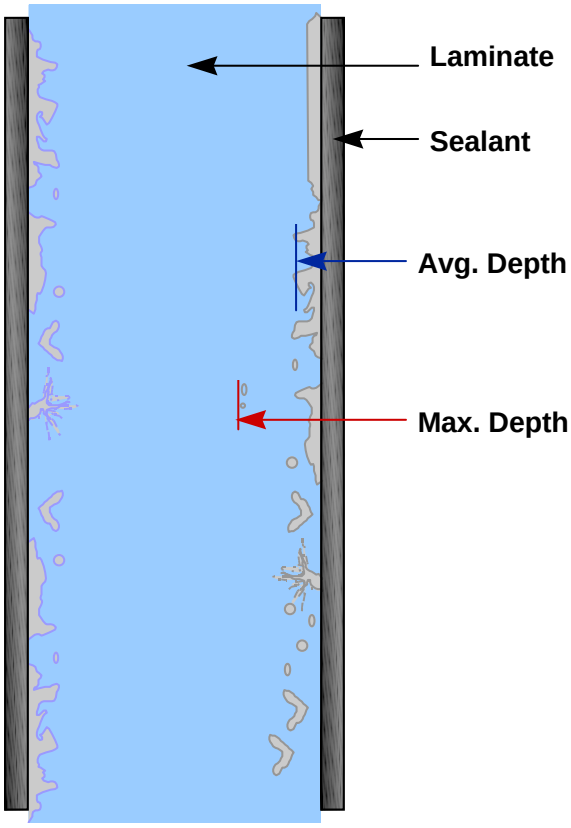
Measurements

Average Depth Edge Effect: - The average depth of anomalies is selected on one edge. A measurement is made from the laminate edge to the center point of the anomaly. This is recorded as the average depth for the side being rated. This procedure is repeated for the opposite side, and for any additional specimens of the sample set. These recorded values for all edges in the sample set are then averaged to get the average depth of edge effect for the set. This number is reported for each rating interval.

Length Affected – measure and sum the length of edge affected by any anomaly. This is rated per specimen and not per side. For this test procedure the maximum length affected is 610 mm (24 inches). This is also report as a percent of the edge affected.

Maximum depth – The maximum depth of penetration of an anomaly rated from the laminate edge inward to the innermost portion of the anomaly. This is the maximum depth. The maximum depth is rated for each side, but only the highest value from all sides of the sample set is reported for that interval. At the end of the study, the highest value reached at any interval is reported as the maximum depth, even if it is not recorded during the last exposure interval.

Figure 1



730 Worcester Street | Springfield, MA 01151
413.730.3413 | jcschi@eastman.com

Calculations

Average Area – product of the length affected per sample multiplied by the average depth.

Percent Length affected – Total length of specimen subtracting total length affected, divided by total length of specimen.

(Tl – Ta)/Tl

Where: Tl is total length of specimen

Ta is total length of specimen affected

Report

Report the following:

Laminated glass configuration: Glass type, thickness and color or coating; Interlayer type, formulation, thickness and color.

Sealant type, formulation and color.

Exposure type and duration

Average depth edge effect for full duration exposure

Maximum depth edge effect for full duration exposure

Percent length affected

Average area affected

Delamination Plateau. Denoted as "Y" indicating that a plateau in the edge effect has occurred; "N" indicating no plateau in edge effect formation has occurred.

Preliminary Exposure: An initial evaluation or screening test can be performed prior to placing the samples in the weathering chamber. If severe delaminations are visible at this time, the sealant can be deemed as grossly incompatible and no further testing is performed. If additional data on rate of edge effect propagation with weathering is desired than it is recommended that the sample be weathered.

Accelerated Exposure - Comments

The accelerated test was developed to simulate actual outdoor exposure results as closely as possible in a reduced amount of time and still be capable of producing data that could yield a reasonable estimate of sealant compatibility. Studies indicate that 3,200 hours of accelerated exposure using the set conditions of UV and condensation described in section 11 will yield comparable results to 2.5 years of natural exposure in Florida.

The accelerated weathering chamber allows close control of alternating cycles of UV radiation and condensation at selected temperatures. The cycle used to predict natural Florida exposure is: 16 hours of UV (no condensation) at 66 C, followed by 8 hours of condensation (no UV light) at 60 C. The UV lamps are UVB-313. Due to their shortwave UV emission, and high energy, these lamps can quickly induce sealant curing reactions which can propagate migration of volatiles and/or plasticizers into or out of the interlayer. They can also cause aging, and other changes in the sealant which could promote edge effects in the laminate edges contacting the sealant.

The condensation cycle which alternates with the UV cycle serves as an accelerator in the curing and aging of the sealant. It also helps to detect glass-to-sealant adhesion loss which could be detrimental to a laminate if left undetected. The effects of water vapor transmission are assessed through use of the condensation cycle.

The test protocol was specifically designed to give a severe sealant-interlayer exposure condition to accelerate possible interactions and permit comparison of results among various sealant types.

The effects of accelerated aging do not mean a sealant showing edge effects from sealant compatibility in the accelerated tests cannot be used successfully in a properly designed system. It also does not guarantee good performance with a sealant showing good performance in these tests. Other factors in preparing the glass or frame in an actual installation, sealant production, sealant formulation changes and shelf life which were outside the scope of this program also may have an effect. For the conditions tested, however, the results provide a reasonable basis for comparing and predicting the interactions of these sealants with interlayers in laminated glass. Consideration of the visible effects of sealants and an understanding of their development by the party accepting the design is recommended.

730 Worcester Street | Springfield, MA 01151
413.730.3413 | jcschi@eastman.com