

EDGE SEALS FOR GLASS LAMINATION

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Proposition

Glass laminators will be able to deliver more durable, longer lasting glass products to their transportation and architectural end-users by employing a new and improved edge-seal technology developed by Argotec, Inc. of Greenfield, Massachusetts USA.

Background

In 1995 Argotec co-developed and began manufacturing its original multilayer edge seal product, BOC-9450 Edge Seal™. Its purpose was to address the problems of chipping during handling and installation of laminated glass products, and to provide some barrier to liquids and gases that could penetrate and damage the glass interlayer while in-service. The edge seal product would protect either TPU or PVB optical interlayers, and the glass, acrylic or polycarbonate substrates. The result was a multilayer construction consisting of a 35-mil adhesive layer of clear, aliphatic thermoplastic urethane (tpu) film bonded to a second, 15-mil layer of black, temperature-resistant aromatic polyurethane, and capped with an embossed polypropylene carrier sheet. The edge seal is slit to the specific width of the laminated glass composite, affixed to the laminate edge just prior to autoclaving, and the polypropylene carrier removed before or after the autoclave process, depending on the user's preference regarding surface finish.

At high temperature and vacuum, the 35-mil adhesive layer melts, flows and then bonds to the edges of all the layers in the laminate. The result is a 50-mil TPU "bumper" that reduces the potential for mechanical damage during downstream handling, and a multilayer tpu barrier to the chemical environment of the end-use.

Need for Improvement

This original BOC-9450 Edge Seal from Argotec has performed well over the years and this design is used by over 90% of all laminators using tpu interlayers. As applications have

evolved, the environments they are exposed to have become harsher and the expectations of the end-users have become high. Solvents contained in the caulks and sealants used during glass installation can penetrate through the edge and attack the interlayers or cause crazing of a polycarbonate layer. Security glass and other high tech architectural laminates are sensitive to attack from moisture and solvent penetration. End-users demand a longer life expectancy, even from traditional PVB laminates. The root cause of these laminate quality issues is chemical migration through the edges. The corrective action is to improve the liquid and vapor barrier properties of the existing edge seal.

Laboratory Test to Model End-Use Environments

Argotec developed a modified version of ASTM E-96 B to measure chemical permeation through edge-seal designs. The modified method gives a relative, side-by-side comparison of vapor permeation in and through edge-seal designs.

Specifically, Argotec used MEK, a solvent commonly used in sealants. Eight-ounce glass jars, 2.5-inches in diameter, are filled half way with MEK. A four-inch square of edge-seal material is sealed to the lid of the jar and weighed. The jar is placed in a laboratory maintained at 72 degrees Fahrenheit and 50 percent relative humidity.

The jar is then weighed every 24 hours for 7 days. The difference in the weight of the jar is reported in grams lost. The area of the edge seal barrier is πr^2 or 4.9 square-inches.

The permeation is then reported as g/area-time. To correlate with the scale of glass applications, the units are converted to grams/sq-meter-week.

For moisture-vapor permeation, Argotec used ASTM F-1249/Tappi T-557. A dry nitrogen carrier with 90 percent R.H. and 37 degrees Celsius were used as the conditions.

New Design

Argotec immediately recognized that metal foils can provide dramatically enhanced resistance to moisture and solvent permeation. Standard BOC-9450 Edge Seal and concept samples of standard edge with a 1.0-mil layer of foil inserted between the black temperature-resistant-tpu layer and 35-mil adhesive-tpu layers were prepared. (The foil version is named **ArgoEdgeSealPLUS[®]**.) Each design was tested per the procedure above with the following results:

Property	Test Method	Value
Adhesive layer melt index	ASTM D-1238	5g/10 min. @ 350°F (177°C)
Average peel	ASTM D-3167	>150 pli
Permeation (method)	Material Tested	g/m ² -week
Moisture (ASTM F-1249)	BOC-9450 Edge Seal	250
	ArgoEdgeSealPLUS	1.2
Solvent-MEK (ASTM E-96B)	BOC-9450 Edge Seal	20
	ArgoEdgeSealPLUS	2

The foil layer provides the improved chemical resistance as expected.

In addition, the foil adds some ductility to the seal, making it more conformable and easier to affix to the laminate.

Manufacturing **ArgoEdgeSealPLUS**

The next step was to develop an extrusion and slitting process to deliver **ArgoEdgeSealPLUS** to laminators.

By careful selection and handling of the proprietary foil layer, a finish master roll is produced: 35-mil aliphatic tpu adhesive layer, 1.0-mil foil layer, 15-mil black temperature-resistant aromatic layer, capped with an embossed polypropylene carrier. The product is extruded in a clean environment. It is then slit and packaged in another clean environment, ready for shipment and autoclaving.

Conclusion

As glass lamination applications and market demands have evolved, end-users require longer-lasting, more durable laminates. Argotec has developed **ArgoEdgeSealPLUS**, incorporating metal foil for improved resistance to chemicals and solvents that can reduce the life span of TPU and PVB interlayered laminates.

About Argotec

Argotec is a privately held, global supplier of custom-engineered, high-performance, polyurethane film and sheet for a wide variety of critical applications. Their films are available in thicknesses ranging from 0.2 to 125 mils, and in widths up to 85 inches. All Argotec films are manufactured to the specifications of their customers. In addition to flat-die, cast-on-carrier and blown-film-extrusion technologies, the company also has expertise in extrusion coating, multi-layer constructions, and closed-cell polyurethane foam sheet extrusion. Argotec sells film & sheet products globally to the international specialty films market, primarily to glass laminators, adhesive coaters, plastics converters and fabricators, as well as to OEM's, under the following brands:

- ArgoBond[®] glass lamination films
- ArgoGuard[®] paint protection films
- ArgoMed[®] medical device and wound dressing films
- ArgoFlex[®] waterproof breathable and textile lamination films
- ArgoGraph[®] graphics printing and overlaminating films

Other successful uses of Argotec films include automotive applications such as weatherable films for paint protection and barrier films for headliners, foamed-in-place seating, head rests and arm rests; performance apparel and footwear applications where waterproof-breathable protection and maximum comfort is required; medical applications, such as elastic tapes, wound dressings, hospital mattresses and covers, transdermal patches, and wheel chair cushions. Other common uses include bladders, hydration packs, inserts, sock liners and mid-sole materials for athletic applications, keyboard covers, industrial bellows, and headset ear cushions.

Further information may be obtained by calling (413)772-2564, faxing (413)772-2565, e-mailing info@argotec.com, or visiting the Argotec website: www.argotec.com.