Why use KRYSTALFLEX®?
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Glass is a wonderful, transparent material used to create a natural, pleasant, indoor environment. Areas without glass can feel claustrophobic while glazed areas can feel ‘open’ & expansive. Glass has the unique feature of offering a physical barrier while still allowing light to pass through it.

From a security and performance point of view glass provides significant design challenges. In addition to allowing light in, glass can also expose the interior to viewing from outside. Glazed areas are often a ‘soft’ point of ‘Intrusion’. Broken glass can be a safety and security concern when laminates are impacted at speed in automotive, rail and aerospace applications. Glass-only laminates have also become heavy, very difficult to fabricate, install and are now inadequate by current performance criteria.

To address these and other ‘transparent’ challenges, the glass industry constantly engineers thinner, lighter, higher performance Glass / Plastic laminates, requiring the unique properties of Krystalflex® Optical Aliphatic film products.

KRYSTALFLEX® urethane interlayers were first developed in the 1980s for glass and plastic laminates to provide effective load transfer between the various sheets and extremely high adhesion when bonding between very different materials. KRYSTALFLEX® urethane interlayers demonstrated a high efficacy in these applications and, unlike PVB, the KRYSTALFLEX® interlayer is fully compatible with polycarbonate & offers superior bonding between glass, acrylic and polycarbonate resulting in excellent physical properties over a wide temperature range. It also
gives the possibility to combine urethane interlayers with traditional PVB in glass windshields to prevent problems such as “cold chipping”. The applicability of KRYSTALFLEX® interlayers to the construction of laminates containing polycarbonate, glass and acrylic has resulted in the development of high performance laminates designed to protect those behind the laminate from a wide range of hazards.

Laminates such as these can be divided into two broad categories.

1) ‘Intrusion-resistant’ / ‘Containment’ laminates which offer improved detention security and unobstructed vision while eliminating the confined look of glass laminates containing bars and metal screens. Typical applications include penal institutions, detention centers, utilities, hospitals and police stations. In addition, institutional laminated architectural GCPs provide increased protection in locations where security has recently become key, such as embassies, computer centers and sensitive research centers. These products are multi-layer laminates where three or more layers of glass / plastic are laminated together with KRYSTALFLEX® urethane interlayers. Additionally, there is the current development of even higher performance attack-resistant / security-glazing laminates constructed using the toughest plastics available and containing multiple layers of glass / polycarbonate and KRYSTALFLEX® urethane interlayers for maximum forced-entry resistance. These GCP laminates are used in very high risk penal, military & government buildings where security is an obvious concern.

2) Ballistic resistant laminates (BRG) include a broad family of multi-ply laminates, layers of glass with polycarbonate / other plastics, in a variety of configurations & performance levels.

Polycarbonate is used extensively in GCPs as it offers 250 times the impact strength of glass. Both the inner and outer layers of the laminates are glass, to provide the durability that the polycarbonate alone could not offer. These laminates can only be produced using the ‘fail safe’ performance of KRYSTALFLEX® urethane interlayer, as TPU is truly compatible with the polycarbonate used to give the laminate impact resistant properties. Within the laminate, both the polycarbonate and urethane are very clear, haze-free plastics that maintain high light
transmission even within thick laminates having multiple layers of polycarbonate and urethane. Composite materials having several thin layers bonded together give far greater attack, impact resistance than a thick monolithic structure. The outer glass surfaces add to the durability of heat and light stable glass-clad polycarbonates. The outer glass layers are usually heat-strengthened to provide increased impact resistance against accidental damage during installation and service.

Laminates produced with glass / polycarbonates and KRISTALFLEX® urethane interlayers can be designed to resist attacks by a wide range of weapons. There are many standards and test methods available throughout the world but virtually all internationally-recognized ballistic standards have two main requirements:

1. the glazing must resist penetration; specified bullet, velocity, conditions... and
2. the spall or flying shards of glass leaving the rear face, as a result of the impact, must be eliminated.

Typical applications include high performance & ballistic-resistant glazing for transportation; armored vehicles, military applications, aerospace laminates and a wide variety of architectural applications requiring intrusion, ballistic & blast resistance.

Huntsman KRISTALFLEX™ Optical Aliphatic (OA) polyurethane polymers are the industry standards for the production of urethane interlayer laminating films for the glass industry. Huntsman is uniquely focused on the needs of the glass laminator. It is with this focus, understanding of applications and the ability to globally interface with laminators, that we are able to engineer performance into a TPU film interlayer. We deliver performance properties in a urethane layer, that make production of ever more challenging laminates possible.
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<thead>
<tr>
<th>Desired Attribute</th>
<th>Product Range</th>
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<tbody>
<tr>
<td></td>
<td>PE 192</td>
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<tr>
<td>Laminate in Same cycle as PVB</td>
<td>⬤</td>
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<tr>
<td>Thick Asymmetrical Laminates</td>
<td>⬤</td>
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<tr>
<td>Thin Asymmetrical Laminates</td>
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<tr>
<td>Easy of use</td>
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<tr>
<td>Can be used without Vacuum Bag</td>
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<tr>
<td>Highest Heat Resistance</td>
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<tr>
<td>Best for Ballistics</td>
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<tr>
<td>Best Low Temp Impact Resistance</td>
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<tr>
<td>Best Adhesion to Acrylic</td>
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<tr>
<td>Low Modulus - Make Flat parts</td>
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<tr>
<td>Best Adhesion at Low Laminating Temp</td>
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<tr>
<td>Best Cost / Performance ratio</td>
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<tr>
<td>Replacement for A/G PVB</td>
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