**Description**
HexBond™ 677 is a high temperature, modified epoxy film adhesive developed for use with HexPly® M77 as a fast curing epoxy prepreg/adhesive system. The cure temperature is 150°C. It can be used for bonding aluminium or steel to composites for the manufacture of hybrid structures. The adhesive contains a carrier to aid handling and resin flow control.

**Features**
- Cures in 4 minutes @ 150°C
- Excellent lap shear and peel performance
- Contains a carrier to aid positioning and handling
- Low tack composition to facilitate automated pick and place positioning
- Compatible with E-coat (KTL) processing
- Low free volatile content below 1%
- Good out life of 4 weeks @ 23°C

**Applications**
- Bonding aluminium to composite materials
- Bonding clean or oily steel to composite materials

**Forms**

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Areal Weight</th>
<th>Colour</th>
<th>Carrier</th>
<th>Roll width (mm)</th>
<th>Roll Size (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HexBond™ 677</td>
<td>450GSM</td>
<td>Blue</td>
<td>50gsm glass veil</td>
<td>1000</td>
<td>80</td>
</tr>
</tbody>
</table>

The film is protected by a covering of release paper and supplied in cardboard boxes.

**Instructions For Use**

**Pretreatment**
It is essential that all substrates to be used are free of contamination and are in as ideal a state for bonding as possible. As pretreatment varies significantly depending on the substrates used, please refer to the Hexcel publication HexBond™ Bonding Technology for optimum procedures.

If there is to be a delay between the pretreatment and bonding of aluminium, the pretreated surface can be protected with HexBond™ 112 surface pretreatment protection solution to conserve the good bonding surface. This will enable bonding to be delayed for up to 3 months without deterioration of the pretreated surface.
Processing
1. Allow sufficient time for the adhesive to warm to room temperature (19°C-27°C) before removing the protective outer cover.
2. Cut the film to the shape and size required.
3. Remove the release paper and position the adhesive on the prepared bonding surface.
4. Complete the joint assembly and apply pressure while the adhesive is being cured. After the adhesive has cured it is advisable to maintain pressure on the bonded assembly until it has cooled sufficiently to be handled without discomfort.

Curing
A cure pressure of around 350 kPa is recommended during cure (compression moulding). HexBond™ 677 should be cured at 150°C for 4 minutes to obtain optimum properties. Alternative cure cycles are given below.

<table>
<thead>
<tr>
<th>Cure Options</th>
<th>Temperature / °C</th>
<th>Time / Min **</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partial Cure</td>
<td>150</td>
<td>2**</td>
</tr>
<tr>
<td>(Green Strength*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Cure</td>
<td>&gt;165</td>
<td>&gt;15</td>
</tr>
<tr>
<td><strong>Option 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-step Cure</td>
<td>150</td>
<td>4**</td>
</tr>
</tbody>
</table>

* Green Strength can be developed through exposure to the standard HexPly® M77 prepreg cure cycle.
** 350 kPa Pressure

Cured Adhesive Properties

<table>
<thead>
<tr>
<th>Test</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass transition temperature</td>
<td>°C</td>
<td>103</td>
</tr>
<tr>
<td>Cured resin density</td>
<td>g/cm²</td>
<td>1.2</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>MPa</td>
<td>50.0</td>
</tr>
<tr>
<td>Tensile modulus</td>
<td>GPa</td>
<td>2.5</td>
</tr>
<tr>
<td>CTE -20 to 70°C</td>
<td>10⁶K⁻¹</td>
<td>65</td>
</tr>
</tbody>
</table>
Rheology

**HexBond™ 677 gel time (hot block)**

![Graph showing gel time vs. temperature for HexBond™ 677](image1.png)

*Figure 1: HexBond™ 677 gel time on a hot block*

**Time to Minimum-Ion Viscosity (IV) and Inflection Point**

![Graph showing time to minimum-ion viscosity and inflection point](image2.png)

*Figure 2: Time to Minimum-Ion Viscosity of a HexBond™ 677 film*
**Mechanical Properties**

All the performance values given in this data sheet are based on experimental results obtained during testing under laboratory conditions. They are typical values expected for HexBond™ 677 prepared and cured as recommended and under the conditions indicated. They do not and should not constitute specification minima.

<table>
<thead>
<tr>
<th>Test</th>
<th>Environmental conditioning</th>
<th>Test temperature (°C)</th>
<th>Oiled steel¹</th>
<th>Steel²</th>
<th>Composite / Aluminium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lap Shear Strength (MPa)</td>
<td>None</td>
<td>-30</td>
<td>34</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>65</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>28 days</td>
<td>-30</td>
<td></td>
<td>31</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24°C 60% RH*</td>
<td>23</td>
<td></td>
<td>23</td>
<td></td>
</tr>
<tr>
<td></td>
<td>21 days</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>40°C 50% RH*</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bell Peel (N/25mm)</td>
<td></td>
<td>23</td>
<td></td>
<td></td>
<td>274</td>
</tr>
<tr>
<td>Climbing drum peel (N/76mm)</td>
<td>None</td>
<td>23</td>
<td></td>
<td></td>
<td>374</td>
</tr>
<tr>
<td>Flatwise Tensile (MPa)</td>
<td>None</td>
<td>23</td>
<td></td>
<td></td>
<td>7.0</td>
</tr>
</tbody>
</table>

1. HX420 LAD cleaned/degreased with solvent and then dried, anti-slushing oil was applied at 3gsm immediately before bonding

2. HX420 LAD cleaned/degreased with solvent and then dried
Shelf Life

- **Shelf Life**: 4 months at +5°C
- **Shelf Life**: 12 months at -18°C
- **Out Life**: 1 month at 23°C

1Shelf Life: the maximum storage time for HexBond™ adhesives from date of manufacture, when stored continuously in a sealed moisture-proof bag at -18°C

2Out Life: The maximum accumulated time allowed at 19-27°C between removal from the freezer for use and return to freezer after use.

The storage life is considered to have expired when any of these conditions has elapsed. Refer to the box label to determine the specific batch expiry date.

Storage

It is recommended to store HexBond™ 677 at -18°C. At this temperature it will have a storage life of 18 months plus an additional out life of 10 days at room temperature.

HexBond™ 677 has been formulated for maximum storage life consistent with its high performance. Certain precautions will help to enhance the storage life as follows:

1. When stored HexBond™ 677 should be kept on a horizontal mandrel passed through the tube core on which the roll is wound. This avoids the risk of local thinning of the film under the weight of the roll. The adhesive should be returned to its plastic bag and re-sealed when not in use.
2. When storing under refrigeration the original packaging should be retained if possible. When returning to the refrigerator after use it is essential to protect the film with a water vapour barrier packaging material such as polyethylene.
3. On withdrawal from the refrigerator the water vapour barrier packaging should not be removed until the roll of adhesive has reached room temperature. This may take up to 24 hours depending on the size of the roll and the temperature involved (failure to observe this will result in the film becoming damp).
4. The film should be handled with care whilst in the frozen state since it will be brittle and easily cracked.

Volatile Content

HexBond™ 677 has a very low volatile content, usually well below 1%. In practice, the loss in weight when cured is negligible and emission of volatile products is not of practical significance.

Associated Products

- HexBond™ 112 surface pretreatment protection solution
- HexBond™ 212 foaming film adhesive
Handling and Safety Precautions
When used properly HexBond™ 677 film adhesives present a low risk of handling hazard for the following reasons:

- The film is covered by protective release paper which is not removed until final component assembly. It should be cut to shape before removing the protective covering and virtually no handling of the film is necessary.
- The film is virtually tack-free at room temperature. The film is dependent on elevated temperature for wetting-out the adherend surfaces.
- The film is volatile-free at room temperature.
- The film is splash-free, leak-free and spillage-free.

However, the usual precautions necessary when handling synthetic resins should be observed. A Safety Data Sheet for HexBond™ 677 is available on request.

Release Certification
The Quality System at Hexcel Composites Ltd, Duxford has been certified to ISO 9001 by Lloyd’s Register Quality Assurance and is approved by the UK Civil Aviation Authority and Ministry of Defence. Certificates of Conformity and Test Reports can be issued for batches of HexBond™ 677 on request.

For more information
Hexcel is a leading worldwide supplier of composite materials to aerospace and industrial markets. Our comprehensive range includes:

- HexTow® carbon fibers
- HexForce® reinforcements
- HiMax™ multiaxial reinforcements
- HexPly® prepregs
- HexMC®-i molding compounds

- HexFlow® RTM resins
- HexBond™ adhesives
- HexTool® tooling materials
- HexWeb® honeycombs
- Acousti-Cap® sound attenuating honeycomb

- Engineered core
- Engineered products
- Polyspeed® laminates & pultruded profiles
- HexAM™ additive manufacturing

For US quotes, orders and product information call toll-free 1-800-688-7734. For other worldwide sales office telephone numbers and a full address list, please go to:

http://www.hexcel.com/contact

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