Reworkability of DBA Adhesives

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Topics

• DuPont’s Philosophy for Rework
• How to disassemble bonded module
  - Manual
  - Automation
• How to clean residual adhesive
  - Chemical method
  - Mechanical method
• Conclusions
DuPont’s Philosophy for Rework
DuPont’s Philosophy for Rework

• DuPont’s rework philosophy is to minimize chemicals and adopt “Mechanical” methods to ensure no chemical damage to the expensive components.

• To ensure “mechanical method” can be effectively executed with high yield, we have developed adhesive formulation that have a good balance between adhesive properties.

• In 2009 DuPont commercialized DBA2000 to overcome reworkability issues and compete effectively with OCA. DBA2000 has excellent rework properties, is easy to separate and clean.
DuPont’s Rework Process
DuPont’s Rework Process

- As adoption of LOCA has increased the requirements on the materials and processes have become more stringent.
- Delamination and bonding mura are key concerns and adhesive have been developed to meet these challenges however rework becomes more challenging.
- DuPont has developed new adhesive to meet these need without scarifying the “Mechanical” rework philosophy.
Disassemble Bonded Module
How to Disassemble Bonded Module - Manual

- For de-bond process a wire is used to separate bonded components, like glass, sensor and LCM.
How to Disassemble Bonded Module - Automation

- De-bond process could be designed as an automatic process. The concept is same as manual process.
Clean Residual Adhesive
## Typical Methods to Clean Residual Adhesives

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component Removal</td>
<td>Residual adhesive is removed by replacing new POL</td>
</tr>
<tr>
<td>Chemical Soaking</td>
<td>Put substrate into chemical solvent, then peel-off</td>
</tr>
<tr>
<td>Mechanical Roll Up</td>
<td>Peel-off adhesive directly</td>
</tr>
<tr>
<td>Temperature-Assisted Peel-off</td>
<td>Heating or cooling can be adapted to help residual adhesive removal</td>
</tr>
</tbody>
</table>

### Chemical Soaking

- Alcohol
- Glue

### Remove POL
How to Clean Residual Adhesive - Chemical Method

- Use solvent to soak adhesive for 5~10mins. Adhesives become softer, then use plastic blade to remove residual adhesive.
How to Clean Residual Adhesive - Mechanical Solution I

- For small size panel, residual adhesive can be removed by itself. Use wand to stick adhesive from corner. It is easy to clean due to good cohesion and elongation.
How to Clean Residual Adhesive - Mechanical Solution II

- The residual adhesive becomes a more complete structure by recoating with an adhesive with good cohesion, it thus becomes easier to be removed by mechanical force.
How to Clean Residual Adhesive - Mechanical Solution III

- Additional PET film is placed on top of recoating adhesive, so it can assist the mechanical separation by peel off PET film.
Rework Tact Time and Yield

• Below is the rework tact time of a 7” TP-to-LCM boning panel from DuPont internal bonding operation experience as well as working together with adhesive customers.

<table>
<thead>
<tr>
<th>Method</th>
<th>Tact time for 7” LCM (min.)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25°C</td>
<td>65°C</td>
</tr>
<tr>
<td>Chemical</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical I</td>
<td>10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Mechanical II</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Mechanical III</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

• The typical rework LCM yield rate from our customers is in the range of 85%~95% depending on the design.
Conclusions
Conclusions

• DuPont had adopted a philosophy of avoiding chemicals and adopting “Mechanical” methods for rework

• DuPont has formulated Vertak adhesive to meet high bonding yield and good reworkability requirements by having better mechanical properties while maintaining good adhesion property

• DuPont Vertak adhesive has proven to work well with customers’ real commercial rework process whether adopting chemical or mechanical methods.

• Tact time can be half of traditional solvent soaking and rework yields can be as high as 95%.
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Appendix-
How to accelerate rework process
How to Accelerate Rework Process - Temperature

• To increase temperature will soften adhesive and it could accelerate rework process when using mechanical force. Therefore, putting debonded LCM on hot plate could get higher temperature.

<table>
<thead>
<tr>
<th>Temperature</th>
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<tbody>
<tr>
<td>25C</td>
<td>30mins</td>
</tr>
<tr>
<td>65C</td>
<td>25mins</td>
</tr>
</tbody>
</table>
How to Accelerate Rework Process- Tooling

- Tooling is a key factor to get more efficient rework process.
- Design proper tooling,
  - Fixture for automation machine
  - Holder for constrain substrates
  - Tool for increasing efficiency of mechanical force