Scratch resistant PMMA made possible in the Value Chain Project
Delta Glass profile

- Manufacturer of acrylic cast sheets
- Production site for Polyplastic, no sales
- 18 workers
- Production in 3 shifts from Monday till Saturday
- Production capacity: 1,500,000 sqm/yr
  (5000 ton PMMA)
Production process

- Monomer MMA (Methylmetacrylate) is casted between 2 glass panels
- A combination of 2 Glass panels with a PVC gasket is a mould
- Polymerisation will take place in autoclaves
- The product is an acrylic sheet PMMA
Acrylic Sheets

- 2 – 12 mm range
- All transparent colours
- Impact resistant sheets
- Niche product, bubbleplex
Applications: Caravans & motorhomes
Applications: hatches for yachts
## Glass versus PMMA

<table>
<thead>
<tr>
<th>Property</th>
<th>Glass</th>
<th>PMMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparancy</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Weight</td>
<td>-</td>
<td>++</td>
</tr>
<tr>
<td>Strength</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Durable</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Scratch resistant</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>
DPI Value Chain Project:
Improved properties of PMMA

- Subject 1: Glassfiber reinforced PMMA
  - Improve strength of a PMMA sheet by casting monomer into a glassfiber filled mould

- Subject 2: Scratch resistant PMMA
  - Development of a Scratch resistant coating suitable for PMMA
Project partners:

- Delta Glass in Tholen
- Plastica in Bergen op Zoom, specialized in thermoforming
- Cortech in Yerseke, water cutting specialist
- C2Coatings in Velp, Coating developer
- Modified Materials In Halsteren, Material Engineering
Carbon fiber reinforced PMMA

Casting at Delta Glass, Testbars cutting realised by Cortech
Reinforced PMMA, creep in time (mm)

Testing provided by Modified Materials
Composite thermoforming

Thermoforming realised by Plastica
Subject 1: Glassfiber reinforced PMMA

Problems:
- Bonding agent in glassfiber interfere with polymerization
- Glassfiber make it impossible to cut the sheet
- Sheets become warped, not flat, difficult to handle
- Entrapped air bubbles remains in the sheet

Solutions:
- Use glassfiber without bonding agent
- Use high pressure watercut machine
- Mould should be equally filled with fibers
- Very difficult to fit this product in our production facility. No short term solution
Subject 2: Scratch Resistant Coating

- suitable for PMMA
- Trials with UV cured coatings, not suitable for outdoor usage
- Trials with Thermo cured coatings with success
- We developed a flow coat technique

*UV cured coating provided by C2Coatings*
Prototype Coating line

- New coating line inhouse this year only for testing
- Suitable for outdoor applications
- High scratch resistance
- With the knowledge achieved we will invest next year in a production line
Lab facilities

- New Laboratory:
  - Atlas Weathering test
  - Ball drop test
  - Charpy test
  - Datacolor
  - Ash content measuring
Lab facilities

- New Laboratory:
  - Cross cut tests
  - Taber & Haze value testing
  - Coating thickness measuring device (micron)
New Markets:

- Windows for Automotive
  Impact resistant & scratch resistant PMMA
New Markets

- Cooling doors for Supermarkets
Conclusion:
DPI value Chain Project gives you:

- Better understanding of your own product
- Project fund open doors to several companies
- Sparring partners, perfect especially for small companies
- Access to new markets
Thank you for your attention!