PBT Introduction

- 1. Factory Outline
- 2. Development of CCP’s PBT
- 3. PBT Process
- 4. Quality Assurance Introduction
- 5. Waste Management & EMS (Environmental Management System)
- 6. Health and Safety Management
Factory Outline
Kaohsiung factory was established in 1972, located in the Jen-Wu Industries District of Kaohsiung county.

- **Factory Area:** 38,360 m²
- **Employee:** 270 persons.
Regional Distribution of CCP Group

Taipei City
Chang Chun Head Office
Dairen, Chang Chiang, Tsu-Kong
Ji Lin Chemical
Sumitomo Batelite (Taiwan)
Rogers Chang Chun
Polyplastics Taiwan

Tai Hong Head Office
Triplex Chemical Corporation
CCP, Shin-Chu Factory, TOK (Taiwan)
Tai Hong Shin-Chu Factory
CCPC, Miao-Li Factory
Chang-Bin Industrial Zone
Mai-Liao Industrial Zone
(Plant Site For NC6)
CCP, Tai-Nan Office
Kaohsiung City
CCP, Kaohsiung Factory
Dairen, Kaohsiung Factory
CCP & Dairen Ta-Fa Factory
Polyplastics Taiwan Factory

Br-FR 3,600 MT/Y
VAM 240,000 MT/Y
PBT 90,000 MT/Y
Allyl Alcohol 100,000 MT/Y
1,4-BDO 130,000 MT/Y
Glass Fiber 13,500 MT/Y
Location of Taiwan
CHANG-CHUNG Plastics Co., LTD.
KAOHSINUG FACTORY LAYOUT
Main Products

- PBT Resin
- PBT Compound
- Melamine Resin Molding Compound
- Urea Resin Molding Compound
- Melamine Resin Adhesive
- Urea Resin Adhesive
- Methylated amino Resin
- Polyester Resin for Powder Coating

- Furan Resin
- Amino Resin
- Paper Resin
- Polyester Plasticizer
- Epoxy diluent agent
- Epoxy Resin
- Textile Resin
- Acrylamide
- Mold Cleaner
- Formaldehyde
Development of CCP’s PBT
Major Developments of CCP’s PBT

- 1971: Kaoshiung factory built
- 1984: PBT bench scale test started
- 1986: Dairen Chemical started 1,4-BDO bench scale test
- 1987: PBT plant was under construction
- 1988: PBT plant completed (resin 3,600MT/Y and compound 7,500MT/Y)
- 1996: 2nd line of PBT completed (resin 3,600MT/Y and compound 7,500MT/Y)
- 1998: Continuous process of PBT resin completed (30,000MT/Y)
Major Developments of CCP’s PBT

- **1998**: Dairen Chemical 1,4-Butanediol plant completed (30,000MT/Y)
  - Brominated epoxy flame retardant at Hsin-Chu factory was completed (3,600MT/Y)
- **1999**: Dairen Chemical Allyl alcohol plant completed (100,000MT/Y)
- **2000**: 3rd line of PBT compound completed (15,000MT/Y)
- **2002**: 2nd continuous process of PBT resin will be completed (60,000MT/Y)
  - 4th & 5th line of PBT compound will be completed (30,000MT/Y)
  - 2nd 1,4-Butanediol plant was completed in August, 2002 (100,000MT/Y)
  - Glass fiber plant at Ta-Fa is completed in September, 2002 (13,500MT/Y)
Development of 1,4-BDO

Allyl Alcohol → 1,4-BDO → THF → PTMEG

- **1,4-BDO**
  - **DCC Ta-Fa**
  - **30,000 MT/Y 1998**
  - **130,000 MT/Y 2002**
  - **DCC Technology**
  - **DCC Catalyst**

- **PBT Resin**
  - **CCP Kaohsiung**
  - **30,000 MT/Y 1998**
  - **90,000 MT/Y 2002**

- **DCC Kaohsisung**
  - **100,000 MT/Y**

- **DCC Ta-Fa**
  - **10,000 MT/Y**
  - **Hodogaya Tech.**
Development of PBT

1,4-BDO

PBT Resin

Br-Epoxy Flame Retardant

Glass Fiber

PTA

PBT Compound

CAPCO
1,420,000 MT/Y
No1 capacity

DCC Ta-Fa
30,000 MT/Y 1998
130,000 MT/Y 2002
DCC Technology
DCC Catalyst

CCP Hsin-Chu
3,600 MT/Y 1998

CCP Ta-Fa
13,500 MT/Y

CCP Kaohsiung
30,000 MT/Y 1998
90,000 MT/Y 2002
CCP Technology
No.1 PTA Process
Continuous Process
Characteristics

1. Good flow ability
2. Low static
3. Good bonding strength
4. Good strand integrity
5. Low fuzz
6. Excellent workability and properties
7. Good dispersion in extruding
1. Reinforce of Plastics
   PBT, PET, PA-6, PA-66,
   ABS, PS, POM, LCP
2. Reinforce of Composite Material
   SMC, BMC
3. Advantage of End Product in Electrical, Electronic
   and Automobile
   * excellent durability
   * high mechanical properties
Package

- 800 kg pallet with bottom discharge.
- 25 kg paper bags with PE-lined.
# PBT Capacity

<table>
<thead>
<tr>
<th>Process</th>
<th>PBT Resins</th>
<th>PBT Compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>Start-up</td>
<td>Capacity</td>
</tr>
<tr>
<td></td>
<td>3,600 MT/Y</td>
<td>7,500 MT/Y</td>
</tr>
<tr>
<td></td>
<td>1988</td>
<td>1996</td>
</tr>
<tr>
<td></td>
<td>Batch</td>
<td>7,500 MT/Y</td>
</tr>
<tr>
<td></td>
<td>3,600 MT/Y</td>
<td>15,000 MT/Y</td>
</tr>
<tr>
<td></td>
<td>1998</td>
<td>Continuous</td>
</tr>
<tr>
<td></td>
<td>30,000 MT/Y</td>
<td>15,000 MT/Y</td>
</tr>
<tr>
<td></td>
<td>1998</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60,000 MT/Y</td>
<td>15,000 MT/Y</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>90,000 MT/Y</td>
<td>60,000 MT/Y</td>
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</tbody>
</table>
### PBT Raw Materials Development (1)

<table>
<thead>
<tr>
<th></th>
<th>DCC Ta-Fa Factory</th>
<th>DCC Kaohsiung Factory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1,4-Butanediol</strong></td>
<td></td>
<td><strong>Allyl Alcohol</strong></td>
</tr>
<tr>
<td>Capacity</td>
<td>30,000 MT/Y</td>
<td>100,000 MT/Y</td>
</tr>
<tr>
<td>Start-up</td>
<td>1998</td>
<td>1999</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>130,000 MT/Y</td>
<td>100,000 MT/Y</td>
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</tbody>
</table>
### PBT Raw Materials Development (2)

<table>
<thead>
<tr>
<th></th>
<th>CCP Hsin-Chu Factory</th>
<th>CCP Ta-Fa Factory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Br-Epoxy Flame Retardant</td>
<td>Capacity</td>
<td>Start-up</td>
</tr>
<tr>
<td></td>
<td>3,600 MT/Y</td>
<td>1998</td>
</tr>
<tr>
<td>Total</td>
<td>3,600 MT/Y</td>
<td></td>
</tr>
</tbody>
</table>
PBT Resin Advantages

- Wide varieties of PBT from same plant (including super low and super high viscosity grade)
- Backward integration of raw material
- Own developed technology
- Innovation R&D
- Captive use for PBT compound
CP Plant
Flow Chart

DMT/PTA
BDO
Catalyst

Paste Preparation

Esterification

Pre-Poly

Finisher

Polymer Filter

Pelletization

PBT Chips (low I.V.)
SSP Plant Flow Chart

1. PBT Chips from CP Plant
2. Dryer
3. Crystalizer
4. Solid State Polycondensation
5. Screening & Cooling
6. PBT Chips (high I.V.)
**PBT Chip Package**

- 850 KG PP Super Sack (moisture ≤ 2000ppm)
- 850 KG Aluminum foil laminate Super Sack (moisture ≤ 500ppm)
- 25 KG Paper Bag (moisture ≤ 2000ppm)
- 25KG Aluminum foil laminate Paper Bag (moisture ≤ 500ppm)
- Customer request
Definition: (Lot ≤ 50 MT)

0202280FJ

Package Silo
Storage Silo
Date
Month
Year

IT’S PACKAGE DATE, NOT PRODUCTION DATE
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GRADE</strong></td>
<td>1100-211M</td>
</tr>
<tr>
<td><strong>NET WT.</strong></td>
<td>850 KGS</td>
</tr>
<tr>
<td><strong>GROSS WT.</strong></td>
<td>854 KGS</td>
</tr>
<tr>
<td><strong>LOT NO.</strong></td>
<td>0202280FJ</td>
</tr>
<tr>
<td><strong>Serial No</strong></td>
<td>011</td>
</tr>
<tr>
<td></td>
<td>QA</td>
</tr>
</tbody>
</table>
PBT Label (25 kg)

聚丁烯對苯二甲酸酯

GRADE : 1100
COLOR : 211M
LOT NO : 0202280FJ
NET.WT : 25 KGS

長春人造樹脂廠股份有限公司
高雄縣仁武鄉仁武村工業一路 14 號
PBT Compounds Flow Chart

1. PBT
2. Glass Fiber
3. Flame Retardant
4. Additives

- Loss in Weight Feeder
- Extrusion
- Pelletization
- Blending
- QC Analysis
- Package

PBT Compounds
# Production Flow Chart of PBT Compound (2)

<table>
<thead>
<tr>
<th>No.</th>
<th>Sign</th>
<th>Flow Chart</th>
<th>Measurement Devices</th>
<th>Quality Item</th>
<th>Assurance</th>
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<tbody>
<tr>
<td>1</td>
<td>○</td>
<td>Blending</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>◇</td>
<td>QC Analysis</td>
<td>Analysis Devices</td>
<td>MI、Ash、Sp.Gr.、TS、TE、FS、FM、Izod</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>○</td>
<td>Package</td>
<td>Scale Automatic Packaging Machine</td>
<td>Weight</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>○</td>
<td>Sale</td>
<td></td>
<td>Analysis Report</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>○</td>
<td>End</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Definition**

PBT 4 1 30 - 104 FC

- **series**
  - 1. resin
  - 2. flame retardant
  - 3. reinforced
  - 4. reinforced flame retardant
  - 5. non-halogen
  - 6. low warpage

- **color**
  - GFS content
    - 15 = 15%
    - 20 = 20%
    - 30 = 30%
  - 94 V-0:
    - 40 = 40%

- **mark**
  - 1: thickness = 0.8mm
  - 6: thickness = 1.6mm
  - 8: thickness = 3.0mm
Lot. No Definition for PBT compounds:

02 02 28 A 01

Year Month Date Mark

Line: A=A line  
     B=B line  
     C=C line
Introduction for QC section

- Raw material analysis & quality control
- Process analysis for PBT
- Final products analysis & quality assurance
- Planning & execution for ISO
Quality Analysis of PBT Resin

Frequency /8 hr
- I.V. (o-chlorophenol @35°C)
- COOH-end group (Titration)

Frequency /3 MT
- Color L, a, b (Colormeter)
- MeltFlow Index (235°C @2.16kg, ASTM D1238)

Frequency /month /major grade or customer request
- Specific Gravity (ASTM D792)
- Tensile Strength (ASTM D638)
- Elongation (ASTM D638)
- Izod Impact Strength (ASTM D256)
- Melting Point (DSC, 10°C/min)
- Molecular Weight Distribution (GPC)
- Oligomer (Extraction)
- THF (Head Space GC 80°C @1hr)
Quality Analysis of PBT Compounds

**Frequency /Lot**
- Melt Flow Index (250°C @2.16kg, ASTM D1238)
- Ash (CCP method)
- Specific Gravity (ASTM D792)
- Tensile Strength (ASTM D638)
- Elongation (ASTM D638)
- Flexural Strength (ASTM D790)
- Flexural Modulus (ASTM D790)
- Izod Impact Strength (ASTM D256)

**Frequency /month /major grade or customer request**
- Volume/Surface Resistivity (ASTM D257)
- Dielectric Strength (ASTM D149)
- Shrinkage (ASTM D955)
- Gas content (CCP method)
Certificate of UL on Apr 1991

UL File No.: E59481
<table>
<thead>
<tr>
<th>Material Dsg</th>
<th>color</th>
<th>Min thk</th>
<th>Flame Class</th>
<th>H</th>
<th>H</th>
<th>W</th>
<th>A</th>
<th>Elec.</th>
<th>RTI (℃)</th>
<th>H</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBT-1100</td>
<td>All</td>
<td>0.75</td>
<td>HB</td>
<td>3</td>
<td>0</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5</td>
<td>HB</td>
<td>3</td>
<td>0</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.0</td>
<td>HB</td>
<td>2</td>
<td>0</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>PBT-1200</td>
<td>All</td>
<td>0.75</td>
<td>HB</td>
<td>3</td>
<td>0</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5</td>
<td>HB</td>
<td>3</td>
<td>0</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.0</td>
<td>HB</td>
<td>2</td>
<td>0</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>PBT-4115(a)</td>
<td>All</td>
<td>0.75</td>
<td>V-0</td>
<td>4</td>
<td>0</td>
<td>120</td>
<td>120</td>
<td>140</td>
<td>-</td>
<td>-</td>
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<tr>
<td></td>
<td></td>
<td>1.5</td>
<td>V-0</td>
<td>3</td>
<td>1</td>
<td>120</td>
<td>120</td>
<td>140</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.0</td>
<td>V-0</td>
<td>1</td>
<td>0</td>
<td>120</td>
<td>120</td>
<td>140</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>PBT-4130(a)</td>
<td>All</td>
<td>0.74</td>
<td>V-0</td>
<td>4</td>
<td>0</td>
<td>120</td>
<td>120</td>
<td>140</td>
<td>-</td>
<td>-</td>
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<td></td>
<td></td>
<td>1.5</td>
<td>V-0</td>
<td>3</td>
<td>0</td>
<td>120</td>
<td>120</td>
<td>140</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.0</td>
<td>V-0</td>
<td>2</td>
<td>0</td>
<td>120</td>
<td>120</td>
<td>140</td>
<td>4</td>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>
CERTIFICATE OF ISO 9002

- Kaohsiung factory promoted ISO 9000 (Quality system) in 1993, and got the first Certificate (PBT) on Jan. 1994. Then we continuously got the other products’ Certificates, now 22 products passed this assessment.
Certificate of ISO 9002, from BSMI, Taiwan
Waste water treatment

Raw water

1st pH adjusted tank → Equalization tank → 2nd pH adjusted tank → Flash mixing tank → Dissolved air floatation system → Buffer tank

<table>
<thead>
<tr>
<th>Quantity (m³/day)</th>
<th>pH</th>
<th>COD (ppm)</th>
<th>BOD (ppm)</th>
<th>S.S. (mg/L)</th>
<th>Temp. (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Water</td>
<td>650</td>
<td>4.5-10</td>
<td>1000-6000</td>
<td>250-2400</td>
<td>&lt; 35</td>
</tr>
<tr>
<td>Effluent</td>
<td>650</td>
<td>7.0-8.5</td>
<td>≤100</td>
<td>≤30</td>
<td>≤30</td>
</tr>
</tbody>
</table>

Effluent

Flow meter → Biological granular activated carbon bed → Dyna Sand Filter → Biofilm contact basin → 2nd Sedimentation tank → Secondary aeration tank

Decanter

Primary aeration tank

1st Sedimentation tank
Air emission treatment

1. PBT Process:

VENT

- Stripping → Scrubber → Boiler
- Reactor → Vacuum → Condenser

2. Stack of boiler:

<table>
<thead>
<tr>
<th></th>
<th>Standard</th>
<th>Detect value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust</td>
<td>314 mg/Nm³</td>
<td>81 mg/Nm³</td>
</tr>
<tr>
<td>SOx</td>
<td>500 ppm</td>
<td>118 ppm</td>
</tr>
<tr>
<td>NOx</td>
<td>250 ppm</td>
<td>152 ppm</td>
</tr>
<tr>
<td>CO</td>
<td>2000 ppm</td>
<td>32 ppm</td>
</tr>
<tr>
<td>VOC</td>
<td>150 ppm</td>
<td>14.5 ppm</td>
</tr>
</tbody>
</table>

The standard of emission:

<table>
<thead>
<tr>
<th></th>
<th>Standard</th>
<th>Detect value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC</td>
<td>150 ppm</td>
<td>140 ppm</td>
</tr>
</tbody>
</table>
We introduced ISO 14000 (EMS system) to our plant in 1996, and got the Certificate of ISO 14001 on Oct. 1996.
Health and Safety Management
Health and Safety Management

- Health and Safety (HS) Practice
- Health and Safety Executive (HSE) Organization
- Labor HS Committee
- Personal Protection Equipment Training
- Dangerous material Management
- Equipment Grounding
- Contractor Management
- Fire Fighting and Explosion Prevent
- Hot Work and Smoking Management
- Fire Protection Training
- Emergency Response Training
.....THE END

THANKS