Nylon is Resilient – What about the Nylon Industry?

6th China International Polyamide & Intermediates Forum
3-5 Dec 2008, Rainbow Hotel, Shanghai, China

Speaker: Charles Fryer
Company: Tecnon OrbiChem

Figure 1
POLYAMIDE FILAMENT WORLD MONTHLY PRODUCTION

Source: Tecnon OrbiChem
Figure 2
GLOBAL PRODUCTION OF NYLON FILAMENT OVER LAST 10 YEARS

Source: Tecnon OrbiChem

Figure 3
WORLD CAPROLACTAM CAPABILITY versus DEMAND 1984-2016

Source: Tecnon OrbiChem
Figure 4
EUROPEAN CYCLOHEXANE, BENZENE, AMMONIA and NAPHTHA PRICES

Dollars Per Ton

Source: Tecnon OrbiChem

Figure 5
CHAIN FROM NAPHTHA TO POLYAMIDE

Dollars Per Ton

Source: Tecnon OrbiChem
Figure 6

ASIAN CAPROLACTAM MARGIN over WEST EUROPEAN
1.03 CYCLOHEXANE + 0.3 AMMONIA

Dollars Per Ton

Source: Tecnon OrbiChem

Figure 7

ASIAN CAPROLACTAM MARGIN over WEST EUROPEAN
1.03 CYCLOHEXANE + 0.3 AMMONIA

Dollars Per Ton

Source: Tecnon OrbiChem
Figure 8
TAIWANESE POLYAMIDE 6 FILAMENT MARGIN over 1.03 ASIAN CAPROLACTAM IMPORT CONTRACT

Dollars Per Ton

Source: Tecnon OrbiChem

Figure 9
TAIWANESE POLYAMIDE 6 FILAMENT PRICE PREMIUM ABOVE POLYESTER FILAMENT

Dollars Per Ton

Source: Tecnon OrbiChem
Figure 10
EAST ASIAN DIFFERENTIAL BETWEEN POLYAMIDE 6 AND POLYESTER RAW MATERIAL COSTS

Dollars Per Ton

Caprolactam Import Contract
Polyester Raw Material Cost = 0.865 × PTA + 0.35 × MEG
Differential
Forecast

Source: Tecnon OrbiChem

Figure 11
CAPROLACTAM PRODUCTION vs CONSUMPTION DISTRIBUTION 2007

SURPLUS:
- China: 6.0%
- West Europe: 6.0%
- East Europe: 4.0%
- N. America: 4.4%
- Japan: 5.8%
- Rest of World: 16.3%
Total: 4,500 kt

SURPLUS:
- China: 7.6%
- Japan: 6.5%
- Taiwan: 11.4%
- N. America: 17.1%
- East Europe: 6.9%
- West Europe: 23.4%
- Rest of World: 19.0%
Total: 4,100 kt

Source: Tecnon OrbiChem
**Figure 12**
**WORLD CAPROLACTAM REGIONAL NET TRADE 2004-2007**

Source: Tecnon OrbiChem

**Figure 13**
**NYLON INTERMEDIATES PRODUCERS 2007**
Share of Production Capacity

Source: Tecnon OrbiChem
**Figure 14**

THE PA66 SUPPLY VALUE CHAIN

Things seemed too good to be true

Source: Tecnon OrbiChem

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**Figure 15**

ADIPIC ACID CAPACITY 2007: ADDITIONS 2008-2010

Source: Tecnon OrbiChem
Figure 16
WORLD ADIPIC ACID SUPPLY/DEMAND BALANCE 2000-2015
Thousand Tons

Source: Tecnon OrbiChem

Figure 17
WORLD ADIPIC ACID REGIONAL NET TRADE
2004-2010est
Thousand Tons

Source: Tecnon OrbiChem
Figure 18
WORLD ADIPIC ACID CONSUMPTION
BY END-USE 2000-2015

Source: Tecnon OrbiChem

Figure 19
MARGIN FOR PA66 1260 DEN FILAMENT PRODUCTION IN ASIA

Source: Tecnon OrbiChem
Figure 20
US BUTADIENE, AMMONIA and NATURAL GAS PRICES

Source: Tecnon OrbiChem

Figure 21
EUROPEAN BUTADIENE, AMMONIA and HEAVY FUEL OIL PRICES

Source: Tecnon OrbiChem
Figure 22
US BUTADIENE, AMMONIA and NATURAL GAS PRICES vs JAPAN IMPORT HMDA cfr PRICE

Figure 23
US BUTADIENE, AMMONIA and NATURAL GAS PRICES vs JAPAN IMPORT HMDA cfr PRICE

Source: Tecnon OrbiChem
### Figure 24

**LONG TERM AVERAGE PRICES OF FIBRES & INTERMEDIATES - Crude Oil ~$50/bbl**

<table>
<thead>
<tr>
<th>Product</th>
<th>Price Per Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA6 Filament</td>
<td>2,700</td>
</tr>
<tr>
<td>PA6 Polymer</td>
<td>2,500</td>
</tr>
<tr>
<td>Caprolactam</td>
<td>1,400</td>
</tr>
<tr>
<td>PA6 Staple</td>
<td>1,100</td>
</tr>
<tr>
<td>PA66 Filament (FDY 70den)</td>
<td>1,100</td>
</tr>
<tr>
<td>PA66 Staple</td>
<td>1,000</td>
</tr>
<tr>
<td>PEs FDY 70 den</td>
<td>750</td>
</tr>
<tr>
<td>PEs Staple</td>
<td>400</td>
</tr>
<tr>
<td>Crude oil - $50/bbl</td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Tecnon OrbiChem

### Figure 25

**LONG TERM AVERAGE PRICES OF FIBRES & INTERMEDIATES - Crude Oil ~$75/bbl**

<table>
<thead>
<tr>
<th>Product</th>
<th>Price Per Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA6 Filament</td>
<td>3,300</td>
</tr>
<tr>
<td>PA6 Polymer</td>
<td>3,100</td>
</tr>
<tr>
<td>Caprolactam</td>
<td>1,300</td>
</tr>
<tr>
<td>PA6 Staple</td>
<td>1,150</td>
</tr>
<tr>
<td>PA66 Filament (FDY 70den)</td>
<td>1,550</td>
</tr>
<tr>
<td>PA66 Staple</td>
<td>1,000</td>
</tr>
<tr>
<td>PEs FDY 70 den</td>
<td>550</td>
</tr>
<tr>
<td>PEs Staple</td>
<td>250</td>
</tr>
<tr>
<td>Crude oil - $75/bbl</td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Tecnon OrbiChem
CONCLUSIONS

- Growth: nylon fibre has been growing at 1.3% per year worldwide, but in recent years this has fallen to zero and negative growth is likely in 2008 and 2009.
- Polyamide engineering resin is growing at around 4% per year, through its penetration into new areas, such as automobile components, but growth will slow or go negative in 2009 with recession in some automobile industries.
- Long term polyamide growth overall (PA6 + PA66) is thus likely to be around 2.2%/year, but only after three years’ loss of growth 2007-2010.
- Poor growth prospects will discourage investment in new caprolactam plants.
- The present pattern of caprolactam trade will thus continue.
- Caprolactam producers are having to pass on to customers all the recent reduction in their benzene, ammonia and energy costs.
- PA66 producers still have high costs, with butadiene prices still high.
- Caprolactam and PA6 will be hard pressed by competition from polyester.
- PA66 is suffering the greatest feedstock pressures, but so far is managing to retain its premium quality image and pricing.
6th China International Polyamide & Intermediates Forum

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