Wood Mackenzie Chemicals

- Complete view of energy supply change
  » www.woodmac.com

- Expert industry knowledge across the chemical supply chain, including:
  » Paraxylene
  » PTA and MEG
  » PET and rPET

- Global coverage of bi-oriented film markets
  » Polyester film
  » Polypropylene film
  » Nylon film

- Global coverage of the flexible packaging market
The North American BOPET film market
Is the price of Brent crude oil on the rise again?

Uncertainty in the market as OPEC have a major decision over Iranian sanctions

- The decision on Iran could have significant impact on oil price
  » Potential to spike above $90 bbl

- Brent has been on an upward trend in 2018
  » Reaching over $80 bbl in September

- Expected to remain at higher levels into 2019

- What impact does oil price have on BOPET film prices?
  » Oil price has direct impact on the PX price
  » Feeds through to the price of PTA
  » Feedstock costs impact BOPET film prices
  » Transportation costs will also increase

Source: Argus, Wood Mackenzie Macro Oils Service
BOPET film raw materials

An eventful year in the North American PTA market...

- Raw material costs for film producers steadily increasing over 2018
- Flat outlook on raw material prices with continued polyester tightness
- US PTA market
  - Force majeure at BP’s Cooper River plant
  - Fire at Alpek’s Altamira plant in Mexico
  - Spike in Asia PX in September had a knock-on impact on the US market
  - September PTA price likely to be the peak as cycle moves to seasonally slower demand period

Source: Wood Mackenzie Chemicals
US BOPET film price

BOPET film prices expected to see another rise during October

- September has seen five producers announce price rises of over 15 c/lb
  - BOPET film price increased by 15% over last year
  - Fourth price rise of 2018 announced in September

- Upward price pressures from market factors in the US in the short term
  - Recovery of recent rises in raw material costs
  - Tighter BOPET film supplies
  - Healthy demand for film

- Upward price pressures likely to ease as film demand softens as year end approaches

Source: Wood Mackenzie Chemicals
North America in the context of the global BOPET film market

A $12 billion global industry which is currently balanced in terms of supply and demand

Global market has seen nearly 7% p.a. growth over last five years, averaging growth of over 7.5% p.a. since 2002

Demand has reached just over 5 million tonnes in 2018
   » Relatively small global industry compared to PE and BOPP film

Demand and production dominated by China & countries in Central & East Asia region

North American (Canada, Mexico, US) region accounts for just over 10% of global demand

Global BOPET film demand by region

Source: Wood Mackenzie Chemicals
Rapid expansion of the BOPET film industry in Asia

China and India now account for nearly 60% of global installed capacity

- Global capacity reached **6.7 million tonnes** in 2018
- **China** alone has installed over 1.2 million tonnes of new capacity since 2013
  » Reaching a total of 3.1 million tonnes in 2018
- Indian-based producers are now global players, accounting for approx. 18% of total global output
- **North American** capacity reached nearly **470 kt** in 2018
  » Accounts for approx. 7% global supply
  » Mitsubishi Polyester Film has a new 25 kt line at Greer, South Carolina now operational

Source: Wood Mackenzie Chemicals
The North American region is a net importer of BOPET film to satisfy domestic demand

- Regional **demand** growth over the last five years has been **over 3% p.a.** reaching **540 kt** in 2018
  - Equivalent to 77 kt of additional demand

- Rate of growth in **supply** has seen only **2% p.a.** growth over the same period
  - Equivalent to 44 kt of additional capacity
  - Or only 30 kt of additional production

- Export volume from North American producers is **small**

- Imports from suppliers outside the region have grown to fill new market needs
  - **180 kt** in 2018
A current view of the North American BOPET film market

North American BOPET film industry not major exporter

North American BOPET film market - 2018

- North American market dominated by the US which accounts for;
  - 90% regional demand
  - 85% regional capacity

- North America is a net importer of BOPET film
  - US market also a net importer

- Canada has no domestic BOPET film production
  - Relies solely on imports to meet domestic demand

- Mexico is the only country to be a net exporter of BOPET film in North American region

Source: Wood Mackenzie Chemicals
### North American leading producers

<table>
<thead>
<tr>
<th>Group</th>
<th>2018 Capacity (kt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Uflex Industries</td>
<td>102</td>
</tr>
<tr>
<td>2 Mitsubishi Polyester Films</td>
<td>83</td>
</tr>
<tr>
<td>3 SKC Co Limited</td>
<td>60</td>
</tr>
<tr>
<td>4 3M</td>
<td>55</td>
</tr>
<tr>
<td>5 DuPont Teijin Films</td>
<td>41</td>
</tr>
<tr>
<td>6 Toray Advanced Film Co. Ltd</td>
<td>33</td>
</tr>
<tr>
<td>7 Polymex Corp</td>
<td>31</td>
</tr>
<tr>
<td>8 Eastman-Kodak</td>
<td>25</td>
</tr>
<tr>
<td>9 Carestream Health Inc</td>
<td>23</td>
</tr>
</tbody>
</table>
US import market

Upward trend of BOPET film imported to the US over 2018

US imports of PET film & sheet – 2018 YTD

- Monthly imports of PET film & sheet increases by approx. 40% over the seven months in 2018
- Main source of US imports is Mexico
- Buyers sourcing film from Europe
  » Germany, UK, Italy and Turkey
  » Proportion will be US producers drawing on stock from European bases
- The issues at JBF RAK has limited buyers offshore options
  » However, there are reports of small amounts of film being imported into the US market from JBF

Source: GTT
Is the planned global capacity being installed in the right places?

Below compares our forecasts of demand growth against announced planned capacity through to 2022.
North American BOPET thick film market

Demand growth of 2% p.a. over last five years reaching 115 kt in 2018

Leading producers in North American thick BOPET film market

<table>
<thead>
<tr>
<th>Producer</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>Mitsubishi Polyester Film</td>
<td>21</td>
</tr>
<tr>
<td>SKC America Inc</td>
<td>21</td>
</tr>
<tr>
<td>DuPont Teijin Films US</td>
<td>14</td>
</tr>
</tbody>
</table>

The North American thick BOPET film market by end use

- Electrical / Electronic: 52%
- Imaging & Graphics: 14%
- Magnetic Tape: 13%
- Packaging & Metallising: 21%
- Other Industrial: 0%

Source: Wood Mackenzie Chemicals
North American BOPET thin film market

Demand growth of 3.5% p.a. over last five years reaching nearly 430 kt in 2018

Leading producers in North American thin BOPET film market

<table>
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<th>Producer</th>
<th>2018 Capacity (kt)</th>
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<tbody>
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<td>Uflex</td>
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<tr>
<td>Mitsubishi Polyester Film</td>
<td>75</td>
</tr>
<tr>
<td>SKC America Inc</td>
<td>39</td>
</tr>
<tr>
<td>Toray Plastics Inc</td>
<td>33</td>
</tr>
<tr>
<td>Polypex</td>
<td>30</td>
</tr>
<tr>
<td>3M</td>
<td>26</td>
</tr>
<tr>
<td>DuPont Teijin Films US</td>
<td>21</td>
</tr>
</tbody>
</table>

The North American thin BOPET film market by end use

- Electrical / Electronic: 54%
- Imaging & Graphics: 6%
- Magnetic Tape: 0%
- Packaging & Metallising: 40%
- Other Industrial: 0%

Source: Wood Mackenzie Chemicals
Regional demand dominated by packaging & metallizing end use sector

- The **packaging & metallizing** sector accounts for 45% of all North American demand
  - Sector growing at approx. 5.5% p.a. over last five years and reached nearly **250 kt** in 2018

- **Electrical & electronic** sector also enjoying health demand growth at 4.5% p.a. over the same period
  - Not quite as large in terms of market size reaching nearly **90 kt** in 2018

- **Industrial sector** has shown modest growth of approx. 2.5% p.a. over the same period
  - Sector remains a significant proportion of the market reaching just over **180 kt** in 2018

Source: Wood Mackenzie Chemicals
North America BOPET film demand forecast

Significant supply demand ‘gap’ developing in the North American region

Regional BOPET film demand & capacity forecast

- **No planned** new capacity to come on-stream
  - Jindal Films America – previously announced 65 kt of new capacity but no further confirmation
  - This is **not** accounted for in this capacity projection

- Regional demand growth is expected to be over **4.5% p.a.** to 2022
  - US demand is slightly higher than the regional average at 4.8% p.a. over the same period

- The regional supply demand ‘gap’ is expected to increase over the period to 2022
  - Importers will have to play a more significant role if no domestic production is installed

Source: Wood Mackenzie Chemicals
What’s driving North American BOPET film demand

Key growth driver will be thin BOPET film in the packaging & metallizing sector

Demand growth for thin BOPET film to 2022
- Electrical / Electronic: 5% p.a.
- Imaging & Graphics: 3% p.a.
- Other Industrial: 6% p.a.
- Packaging & Metallising: 5% p.a.

Demand growth for thick BOPET film to 2022
- Electrical / Electronic: 4% p.a.
- Imaging & Graphics: -3% p.a.
- Other Industrial: 7% p.a.
- Packaging & Metallising: 3% p.a.

Source: Wood Mackenzie Chemicals
Where does that leave US buyers?

What are the risks of no investment in domestic capacity?

- Healthy domestic demand
- No new domestic investment in low cost production
- High domestic capacity utilization rates
- Longer domestic lead times – now up to 6 weeks
- Even longer overseas supply chains
  - Global tightness in supply
  - BOPET film prices in all regions increasing
  - US import tariffs
  - Rising transportation costs

Higher BOPET film prices

Source: Wood Mackenzie Chemicals
Sustainability – a risk or opportunity?

Media scrutiny and public perception has the potential to hamper forecast growth in flexible packaging

- North American market will continue to see shift away from traditional packaging materials such as glass, metal cans, rigid packaging towards flexible packaging
- **Reduce**
  - Flexible packaging uses less packaging material
  - Lower volume of plastic packaging enters the waste stream
- **Re-use** – more difficult
- **Recycling**
  - A key role of the polyester industry in helping develop closed loop recycling streams and technologies
    - The use of *multi-layer laminates* in flexible packaging
- **Avoid** incineration and landfill
And what does this mean for AIMCAL members

Opportunities are there for those that act now

- Secure a cost **effective GLOBAL supply** chain solution – higher BOPET film prices are inevitable

- BOPET film – a sustainable film?
  - The **unique properties** of polyester mean it is difficult to achieve the same technical properties at a similar cost with other polymer substrates
  - But it has to be used in a **multi-polymer laminate**

- Urgently need find commercial solutions to handling BOPET film as **post-consumer waste**
  - Development of **single polymer** oxygen and moisture barrier packaging
  - Development of technologies to **separate** laminate layers
  - Recover BOPET films with metal, coatings

- Create **closed loop systems**
  - So material never enters the waste stream
The North American BOPP film market
US BOPP film price

BOPP film prices rise in Q3 2018 as price of resin increases

- BOPP film price index in the US increased 12% in Q3 2018
  - May 2018 saw a 15 c/kg increase
  - June 2018 saw almost 18 c/kg increase

- **Upward price pressures** from resin costs
  - In a number of cases, increase in resin costs been fully reflected in the increase to BOPP film prices
  - PP monomer demand has been high
  - **Force majeure** at some resin producers

- **US BOPP film producers fully loaded in Q3 2018**
  - Demand usually softens this time of year but this has not happened this year

Source: Wood Mackenzie Chemicals
Global BOPP film market

A global $17 billion industry that is currently balanced in terms of supply and demand

Global BOPP film demand by region

- The global BOPP film market has been growing at approx. 5% p.a. over the last five years
  - Global demand expected to reach nearly 8.5 million tonnes in 2018

- Global market dominated once again by Asia and in particular China
  - China accounts for nearly 50% of global demand in 2018

- North American (Mexico, Canada, US) region accounts for nearly 10% of global demand in 2018

Source: Wood Mackenzie Chemicals
North American BOPP film market

Lack of investment in low cost production lines has seen the region become a significant importer of commodity films

- Regional **demand** growth over the last five years has been **over 2% p.a.** reaching **770 kt** in 2018
  - Equivalent to 85 kt of additional demand

- Rate of growth in **supply** has seen **over 4% p.a.** growth over the same period
  - Equivalent to 167 kt of additional capacity
  - But just 35 kt of additional production

- Imports from suppliers outside the region have grown to fill new market needs
  - Just over **160 kt** in 2018

Source: Wood Mackenzie Chemicals
The leading North American BOPP film producers

Only two of the leading producers are active in both BOPP and BOPET film markets

<table>
<thead>
<tr>
<th>Producer</th>
<th>Plants</th>
<th>2018 Capacity (kt)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inteplast Group</td>
<td>US &amp; Canada</td>
<td>255</td>
<td>Amtopp BOPP film division</td>
</tr>
<tr>
<td>Jindal Poly Films</td>
<td>US</td>
<td>143</td>
<td>Active in both BOPP &amp; BOPET film globally</td>
</tr>
<tr>
<td>Taghleef Industries</td>
<td>US &amp; Canada</td>
<td>80</td>
<td>August 2018 Taghleef announced acquiring Biofilm’s operations in Mexico &amp; Colombia adding a further 100 kt capacity</td>
</tr>
<tr>
<td>Altopro S.A. de C.V.</td>
<td>Mexico</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td>Treofan Group</td>
<td>Mexico</td>
<td>71</td>
<td>July 2018 CCL Industries completed purchase of Treofan’s Mexican film manufacturing interests &amp; US sales operation</td>
</tr>
<tr>
<td>Grupo Convertidor Industrial</td>
<td>Mexico</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Biofilm S.A.</td>
<td>Mexico</td>
<td>55</td>
<td>See comment above</td>
</tr>
<tr>
<td>Toray Industries Inc</td>
<td>US</td>
<td>50</td>
<td>Active in both BOPP &amp; BOPET film globally</td>
</tr>
<tr>
<td>3M</td>
<td>US</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Intertape Polymer Group</td>
<td>US</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

Source: Wood Mackenzie Chemicals
North American BOPP film market by film characteristic

Transparent film dominate regional demand but specialty films remain an important market sector

Regional BOPP film market by film characteristic - 2018

- **Transparent film** accounts for just over 70% of regional demand in 2018 reaching nearly 560 kt in 2018
  - Majority of regional growth will come from simple transparent commodity films
  - Expected growth rate of nearly 4% p.a. to 2022

- The **metallized film** sector accounts for nearly 20% of the regional market reaching nearly 140 kt in 2018
  - Expected growth in this sector is expected to be modest at around 2.5% p.a. to 2022

- **Specialty films** will remain an important sector for North American BOPP film producers

Source: Wood Mackenzie Chemicals
North American BOPP film market by end use application

Food packaging dominates regional demand and will continue to grow in influence

Regional BOPP film market by end use

- **Food packaging** accounts for nearly 80% of regional BOPP film demand reaching **610 kt** in 2018
  - Historical growth over the last five years has been below the global average at around 2% p.a.
  - However, this is expected to pick up at the sector is forecast to growth at 3.5% p.a. to 2022

- Continuing shift towards flexible packaging away from the more traditional packaging formats of glass, metal cans, rigid plastic driving growth

Source: Wood Mackenzie Chemicals
Global BOPP film supply demand forecast

Announced new capacity coming onto the market but not enough to close the supply demand ‘gap’

Regional BOPP film demand & capacity forecast

- New regional capacity has been announced
  - Altopro S.A. de C.V. installing 7.2m wide 38 ktpa line in Mexico
  - Jindal Poly Films announced a 10.4m wide 55 ktpa in the US for 2018
  - Treofan Mexico S.A. de C.V. already installing a 10.4m wide 45 ktpa line in Mexico for 2018
- Regional demand growth is expected to be over 3% p.a. to 2022
  - US demand is expected to grow in-line with the regional average over the same period
- The regional supply demand ‘gap’ is expected to increase over the period to 2022
  - Importers will have to play a more significant role if no more domestic production is installed

Source: Wood Mackenzie Chemicals
Summary: North American BOPP film market

Very mature market offering steady growth forecast but continuing to be dominated by the needs of customers in the US

- The conservative approach to packaging in the US has seen a slow transition to flexible packaging over traditional rigid packaging formats

- Regional growth driven by simple transparent commodity BOPP film used in food packaging

- US trade war with China
  - Opportunity for industrial sector as domestic adhesive tape producers could gain more business if situation escalates

- Film substitution
  - Will see a move away for polypropylene towards polyester-based films?

- Same sustainability issues as with BOPET film
Closing Remarks
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