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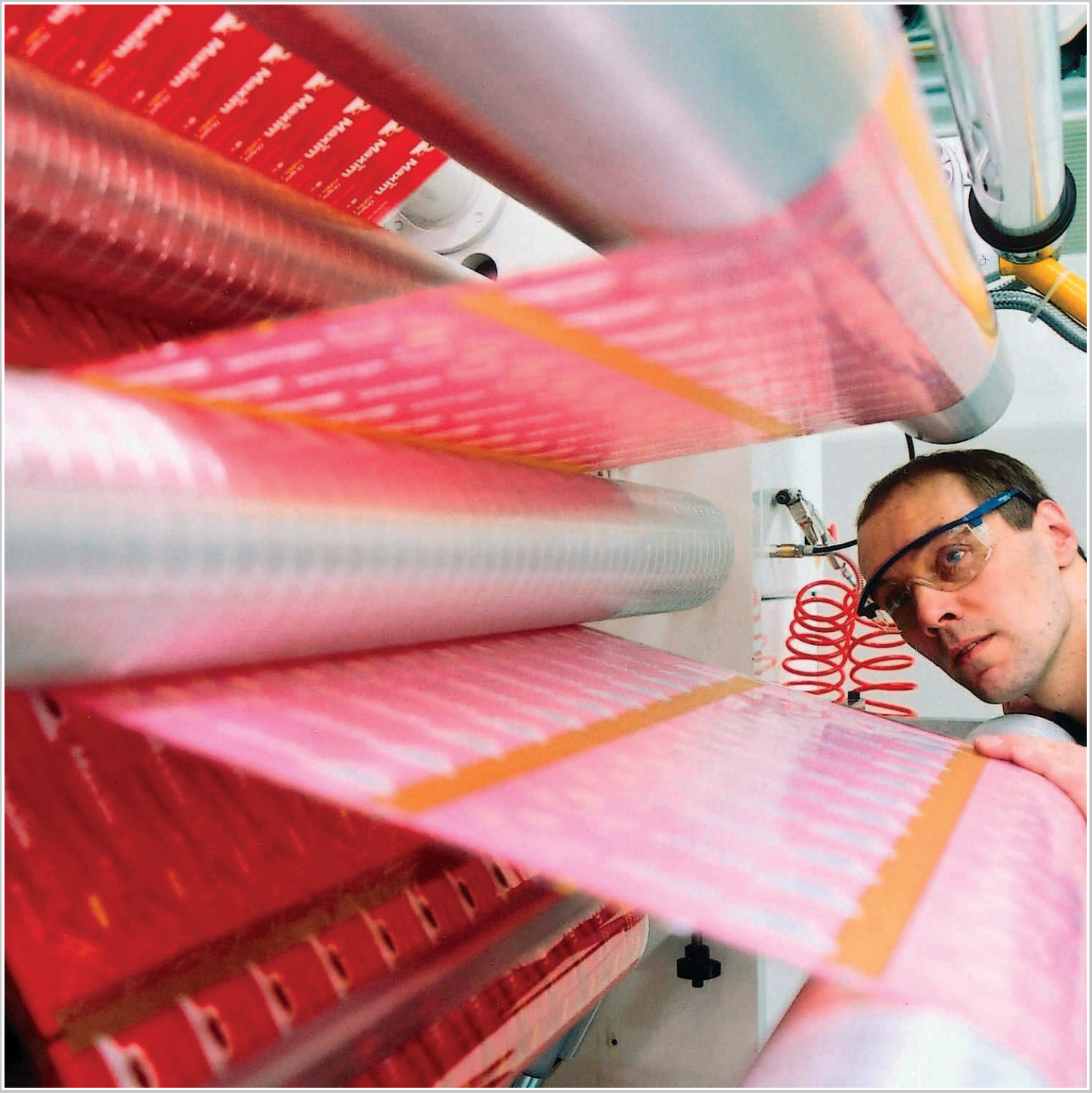
Packaging Films

Global Technical Magazine on Packaging Films and Laminates – Materials, Production and Converting



www.flexo.de

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■ UAE

Entering bioplastic markets

TAGHLEEF INDUSTRIES ■ *The leading BOPP film producer announced its commitment to the development of sustainable packaging by introducing a fully natural film range. The films will be based on Nature-Works PLA (Polylactic Acid) polymers, which are marketed under the brand name Ingeo and which are 100% made from renewable resources. This natural origin combines the advantages of both not using oil-derivates as a raw material as well as offering a wider range of end-of-life options, including recycling and industrial composting.*

Valerio Garzitto, CEO Ti Europe explains »We are putting substantial effort into upgrading our production for the manufacturing of BOPLA films at our Italian site. We will launch the new BOPLA product range in Q4 this year and will offer a film portfolio of different thicknesses and aesthetical appearances to meet customers' requirements. The new compostable films can be used in various packaging applications, such as fresh produce, bakery, dairy or confectionery and will complement the existing bioplastics used in packaging already«.

➜ *www.ti-films.com*

■ WORLD

The world flexible packaging market

PCI ■ Total world demand for converter supplied consumer primary flexible packaging in 2008 was USD 58.3 billion of which Western Europe, North America and Central and East Asia accounted for 75% of the total.

Over the last five years, the world converted flexible packaging market has grown by an average 5.9% per annum. With the exception of Western Europe (excluding the effects of the weakening US Dollar) all world regions experienced solid growth ranging from around 4% per annum in North America to 9% in South East Asia and Oceania and Eastern Europe.

By far the most dynamic markets have been China and India, each growing historically in value terms by around 12% and 17% per annum respectively.

The flexible packaging industry is seeing the emergence via acquisition and organic growth of a number of truly global players to meet the needs of their global customers. Further consolidation at both the regional and global level is expected over the next five years. The top 20 world converters accounted for just under 40% of the global 2008 demand.

After suffering from the effects of the global recession, *PCI* forecasts that world flexible packaging growth will slow in value terms to an average of 3.2% per annum to reach USD 68.1 billion by 2013. Growth in the two regions making up Asia Pacific will account for 55% of world growth over the forecast period.

By 2013, Central & East Asia and South East Asia & Oceania (combined) will emerge ahead of North America and Western Europe as the world's largest regional flexible packaging market, accounting for a little over one-third of total demand. China on its own will have a 10% share of global demand (up from 8% in 2008) and India too will become a significant producer and consumer of flexible packaging materials.

➜ *www.pcifilms.com*

■ UAE

Getting plastics trade right

EDC ■ The value of exported plastics films in Dubai moved beyond AED 304 million in 2009, according to a *Dubai Export Development Corporation* report, exceeding imports by nearly AED 100 million.

Despite a sharp decline in imports and exports in 2009, the Emirate has boasted steady growth in direct trade for commodities including Polypropylene, PET and PVC since 2004. Target export markets for Polypropylene include regional markets such as Egypt, India and Pakistan, and distant countries including Italy and Brazil.

PET, meanwhile, saw a substantial rise in imports and exports during 2009 following a sharp increase in trade volumes since 2006. The top destination for PET films direct exports in 2009 was Egypt.

Plastics films offer a promising market in Europe. In 2008, Polypropylene imports to the EU registered more than USD 4 billion while PET was USD 2 billion.

➜ *www.dedc.gov.ae*

■ WORLD

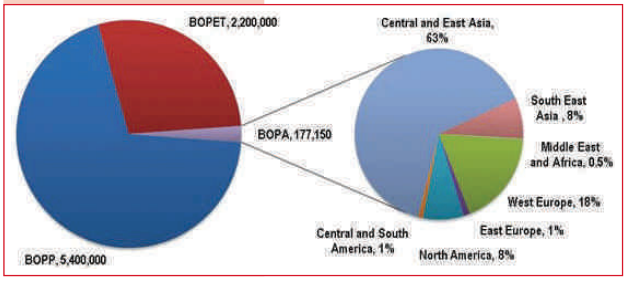
BOPA trends

PCI ■ Since 2004, the world BOPA film industry has doubled and rapidly outpaced demand growth. *PCI*'s Managing Director, Simon King, states that »The massive increase in capacity that occurred in the past has finally been absorbed into the market. Projections for demand growth over the next five years suggest that new capacity is required to satisfy world demand«.

Capacities grew at high rates between 2004 and 2006, with China alone seeing the entry of ten new producers into the domestic BOPA film industry. In addition, suppliers in other mature markets, such as North America expanded capacity to meet local and export needs, making the oversupply situation even more acute. This excess capacity intensified competition and caused world production utilisation rates to fall by 20%, putting pressure on prices and margins and expanding the market horizons of most suppliers as they sought business to fill their plants. The solution was to idle capacity, re-engineer some lines to produce other films and to run lines at reduced speeds. Some producers even exited the industry altogether.

Looking to the future, flexible packaging converters in all parts of the world, interviewed for this report, suggest that historic levels of demand growth are not going to slow significantly up to 2014. As a result, in order for world requirements to be met, further capacity must be introduced, according to *PCI*. This is already being addressed by some industry players; with capacity expansions being planned for 2010 and 2011. *PCI* is confident that the industry will need more capacity, as it is likely to struggle to meet needs after 2012.

➜ *www.pcifilms.com*



Line conversion from BOPP to BOPLA

Biodegradable polymers from renewable resources are playing a more and more important role in the plastic industry. Marketing institutes expect an annual growth of up to 25% to the year 2025 on the total consumption of all »green« plastic materials. Taghleef Industries (Ti), a worldwide leading BOPP producer with operations in the UAE, Oman, Italy, Hungary, Egypt and Australia, recognised the opportunity to catch up with the small and exclusive group of specialised BOPLA producers around the world. Based on Ti's own researches and the long track record of Brückner's tests performed on its laboratory line, a concept was created to modify one of Ti's existing lines in Italy in order to produce BOPLA. The new film products will be marketed under the brand name Nativia.

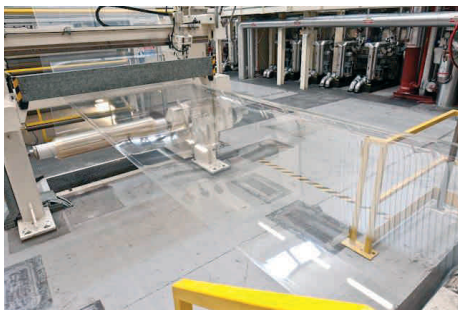
Brückner Servtec GmbH, the upgrade division within the Group, developed special layouts for the modification of the extrusion system, casting and TDO units (Transverse Direction Orientation) the main components being subject to change, but also to peripheral components. *Taghleef Industries* also purchased and installed equipment, which was discussed earlier with *Brückner*, but could also be readily purchased from third-party suppliers. In order to utilise all new components in an efficient way, the process control system has also been updated. Raw material supplier *NatureWorks LLC*, wellknown for its *Ingeo* Polylactide resin, was included in the process of finding an acceptable layout and parameters.

Startup of the new line on August 18, 2010 was one month ahead of schedule; the following week commercial production commenced successfully. First shipments of *Nativia* were in September 2010.

Necessary modifications

Beyond this specific project, which successfully proved the practicability of their BOPLA design concept, *Brückner* wishes to provide general recommendations for converting a line producing BOPP to BOPLA:

- *Raw material handling.* Very few BOPP lines are equipped with desiccant bed dryers designed to dry down to less than 250 ppm moisture. In addition, and perhaps more importantly, once the material is dried, it needs to be conveyed to the extruder with dry air to keep the resin from regaining moisture. All the blending and holding hoppers also need to be sealed to keep a dry environment for the resin. Drying of PLA is necessary to produce BOPLA film.
- *Extrusion.* Although not ideally suited for melting PLA, most extruders designed for processing PP would be able to melt and process PLA to some degree with an acceptable performance. Typically, the higher shear rates and longer L/D (length/diameter) required for PP are unnecessary for PLA and lead to higher than desired melt temperatures when exiting the extruder. Therefore, extruders designed for PP will generally be limited at a much lower rate than PP due to excessive shear heating and melt temperature. Whilst not absolutely necessary for short experimental runs, long term commercial production of BOPLA film at economically viable levels for a given extruder would require a screw change to one particularly designed to process PLA. An option could be to change the whole extrusion system to a twin screw design which processes the melt more gently and the moisture extraction system is already included.
- *Filtering.* PLA is highly filtered during its manufacturing process to remove gels that could cause disruption in the orientation process. Since the chemical nature of PLA is such that gels are unlikely to form during extrusion, significant filtration at the extruder is unnecessary and in fact can be harmful. The large candle filters, typically used in many OPP extrusion lines, add significantly to the holding time of the PLA at melt temperature. In addition, the increased back pressure generated on the screw increases the melt temperature of PLA. The combination of increased melt temperature and waiting time is detrimental to PLA in many ways. First, it can lead to a loss of molecular weight of the resin, which will reduce melt strength and possibly reduce properties. Even without a loss in molecular weight, the increased melt temperature would cause a loss in melt strength and lead to difficulties. Finally, the yellowness index of the material can increase to unacceptable levels with long waiting times and increased melt temperatures. The replacement of a large candle type filter with a design of short waiting time, low pressure drop and higher mesh width is necessary to produce BOPLA.
- *Metering.* The metering gear pump used to control the flow of polymer to the die from the extruder can generally be used for processing PLA for short term experiments. However, for long term production, it is important that the material from which the equipment is made should be suitable for PLA. Since metering pumps use the polymer melt to lubricate the pump bearings, it is critical that they be resistant to corrosion. Once again, replacement of pumps for short campaigns or trials is not necessary but for continuous manufacturing of BOPLA films, the proper equipment would be necessary.
- *Die.* Today, most dies are manufactured with regard to the rheology of the resin that will be flowing through them. Since the rheological characteristics of PP and PLA are significantly different, it is unlikely that the die designed for a BOPP line will perform as well as one designed for BOPLA. Another factor to consider is the width of the die. The transverse draw ratio of most BOPP lines is in the range of 7–10. PLA



First melt of the Nativia film.

will not stretch that far and optimum TD (transverse direction) draw ratios are in the range of 3–5. Therefore, if a die designed for PP is used for PLA, the final film width will be considerably narrower than the normal PP film. A direct result of this is a loss of production capacity. It may also not be possible to move the oven rails close enough to process the film without major modification work (see more in the TDO section below). While it is not required to change the PP die for a short test or evaluation, any long term production of BOPLA film will require a die designed for PLA.

- *Pinning.* Most BOPP lines use an air knife to pin the molten web to the primary chill or casting roll. Since PLA has a considerably lower melt strength than PP, this method of pinning is unsuitable for PLA and electrostatic pinning is required. PLA is naturally highly polar so no additional pinning agent is required.
- *Machine Direction Orientation* (*MDO*). PLA has a natural stretch ratio much lower than PP. MDO stretch ratio for PLA is in the range of 2–4 compared to PP, which is generally in the range of 5–6. Drives in the MDO section should be capable of operating at the lower stretch ratios. In addition, the stretching temperature of PLA is much lower than PP and the preheating and stretching rolls should be capable of maintaining temperatures in the range of 40–70 °C (104–158 °F). Both the stretch ratio and stretch temperatures are required for PLA and if the MDO section is not capable of operating at these conditions, the MDO section needs to be modified.
- *Transverse Direction Orientation* (*TDO*). Once again, the transverse stretch ratio for PLA is much less than PP. Typically, the maximum TD stretch ratio for PLA is 5 while the minimum stretch ratio for PP is 8. Therefore, the rails of the stretching oven must be capable of being adjusted to accommodate the narrower web at the end of the oven. PLA also necks in more during the MD stretching so the oven inlet spacing generally needs to be narrower than for PP. As in the MD stretching, the stretching temperatures are much lower than for PP and the oven must be able to control the preheat temperatures in the 50–70 °C (122–158 °F) range, the stretching temperatures in the 65–80 °C (149–176 °F) range and the heat setting (annealing) temperatures in the 120–140 °C (248–284 °F) range. All of these are required for the production of BOPLA film.
- *Trimming and edge trim recycling.* BOPLA edge trim has very different characteristics compared to PP edge trim and must be handled in a similar manner to BOPS edge trim. The high modulus and tendency to split and shatter prevents the conveying of long continuous strips of edge trim from a blade to a remote grinder. Due to the low glass temperature of PLA, which is between 58–60 °C (136–140 °F), a precutter needs to be installed; otherwise the edge trim strip can stick inside the conveying pipe. The edge trim must be cut into small pieces approximately 1" (25.4 mm) long with a cutter located close to the trimming blades. These chopped pieces can then be air conveyed to a grinder for final size reduction. The maximum temperature of the grinder must be significantly below 58 °C (136 °F) otherwise the PLA flakes can become very sticky.
- *Winding and tension control.* BOPLA film and sheet has a much higher modulus than BOPP film and sheet. Furthermore, the material behaves more like a glassy material and does not yield at low stresses. Because of this, the tension control and web temperature of the web between casting and MDO and between MDO and TDO is critical. If the tension is too high, the web can transmit tension back to a point where the material is warm enough to yield which can lead to difficulty in gauge and web width control. Depending upon the line's capabilities, changes to tension control may be required before running PLA. Because PLA has high polarity, excellent static charge dissipation is necessary to eliminate the static charge on the running web.

Growing demand for green packaging

The growing demand for BOPLA packaging material is being primarily triggered by the food industry, which is looking for adequate packaging of their healthy nutrition. Consumption decisions based on terms like sustainability and renewability have become a characteristic behaviour for many middle and upper class consumers. This follows a trend of increased awareness of environmental issues, something we can already observe in other industries, such as automotive (hybrid cars, electric cars) or energy (wind turbines, solar panels). Many consumers are willing to spend more for their purchases, if they can contribute to the protection of our natural resources.

In addition to this trend, BOPLA materials have certain properties, which are advantageous for specific packaging requirements. Their excellent optical properties combined with high stiffness make BOPLA an attractive cover for food and textiles. Resistance against oil, grease and alcohol and a low water vapour barrier are beneficial for a variety of »challenging« foodstuffs. Low sealing temperatures, high sealing strength, good printability and excellent twistability also provide a wide range of applications.

Today, the supply of BOPLA resin is safe and recently *NatureWorks* doubled the production capacity of its *Ingeo* product range now producing up to 140,000 tpa. A strong interaction exists today between resin manufacturers, film or other plastic goods manufacturers the big food companies and the retail chains. There will be more and more applications, a fact which is also fuelled by rising public concerns about the risks of oil exploration.

➜ *www.brueckner.com*
➜ *www.ti-films.com*
➜ *www.natureworksllc.com*

Pull roll.