



Production line for BOPP film and winder
(figures, except Figs. 1,6 and 8: Brückner)



Invisible Barrier Features

Plastics Film Production. Oriented films started their successful career in the 1960s. They turned out to be extremely versatile with path-breaking barrier properties, equipped with “intelligence”, they are an essential advertising medium. In future they will also be required to make a positive contribution to environment protection, from sustainability and a small carbon footprint to an economical use of resources. With the development of new packaging solutions and a wide range of new technical applications, it seems likely that the positive trend for such films will continue.

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Long gone are the days when corner shops offered candies and chocolate in open containers, milk was sold in glass bottles, and meat, sausages and cheese were mainly displayed unpackaged behind the counter.

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Today, the shelves and display refrigerators are filled with packaged food. Its shelf life continues to increase steadily, and the packaging is not only an important marketing instrument at the point of sale but also provides the customer with information about all the ingredients. This applies especially to highly developed regions, the so called “saturated markets”, but the development can also be seen in emerging economies. Reasons for this include demographic changes

such as urbanization and political and market-economic factors such as the trend towards hyper-stores and mega-shops. Another important factor is the continued advancement of flexible plastics packaging – with bi-axially oriented films being used in nearly every application.

The successful career of these plastics films started in the mid 1960s when BOPP (bi-axially oriented polypropylene) increasingly replaced cellophane

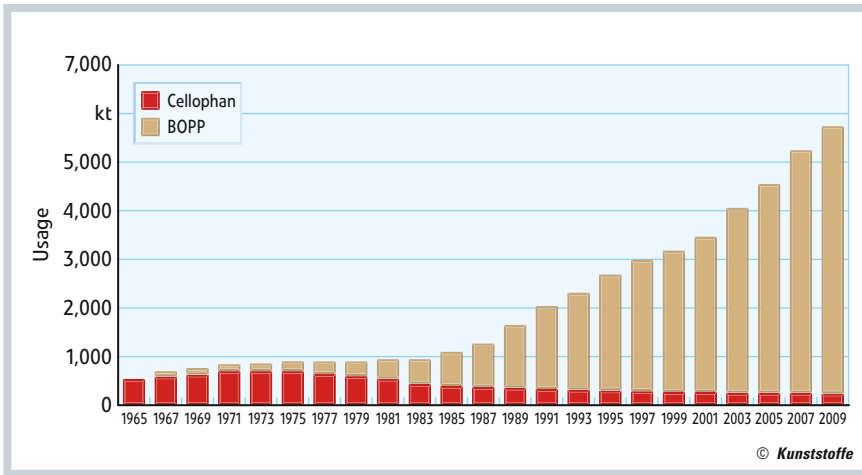


Fig. 1. Development of consumption of BOPP films during the past 40 years

(source: AMI BOPP Report 2010)

(Fig. 1). Nowadays BOPP is used for a wide variety of food packaging, as are BOPET, BOPA and BOPS.

In different process units the films are metallized, printed, coated and then laminated to create a packaging compound. Such flexible packaging is used to protect the goods, extend shelf-life and facilitate an optimal marketing within the consumer goods industry (Fig. 2).

Requirements and Properties

The requirements for packaging films are constantly rising. There is a need for thinner films with equal or even improved mechanical and optical properties, and higher barrier properties against gases such as oxygen and water vapour, in order to increase the shelf-life of the foodstuffs. At the same time the number of processing steps is being reduced, thereby fulfilling the increasingly stringent environment protection requirements.

In this respect bi-axially oriented films and the continued improvement

of the associated manufacturing technologies offer attractive options, including multi-layer films with reduced thickness and weight or the combina-



Fig. 2. Typical applications for flexible packaging

tion of various polymers within the production process.

Production lines with multi-layer technology provide a variety of options for the manufacture of innovative films (Title picture). The trend to 5-, 7- or even 9-layer film compounds, already known in the

cast or blown film sector, is increasingly also entering the BO film area, proving the superiority of oriented film. One example: major brand owners are very interested in replacing aluminium foil by metallized ultra-high barrier film.

This 5-layer film was developed at Brückner Maschinenbau's technology center in Siegsdorf, Germany (Fig. 3). A special high surface energy polymer in the outer layer results in a considerably higher density which is important for the downstream metallizing process. The barrier properties are correspondingly increased:

- Oxygen barrier 0.33 [cm³/(m² dbar)]
- Water vapour barrier 0.45 [g/(m² d)]

With these improved barrier properties the film makes a suitable substitute for aluminium foil in certain packaging applications.

But there are other promising developments:

- Transparent 7-layer barrier film with EVOH layer
- Bi-axially oriented polyethylene for "low shrink packaging"
- Biodegradable film made from PLA (polylactide) for packaging, shrink and thermoform applications

Some of these developments are already well positioned in the markets, while others are attracting considerable attention within the value chain. At present, the required volumes of these special films are relatively modest due to the different interests and current state of knowledge along the value chain. But as information becomes more widespread and sustainability becomes an increasingly important factor, innovative products like these will become progressively more successful.

The Markets

A survey of the worldwide market shares of the different BO films reveals that →

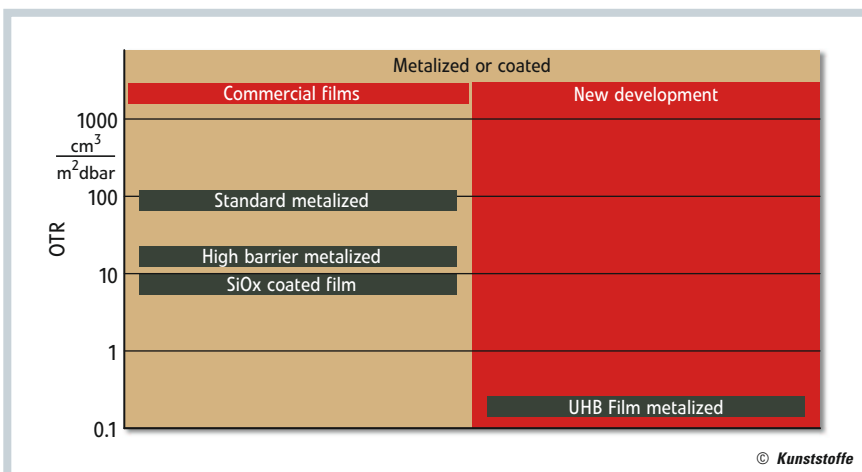


Fig. 3. Barrier values for the new UHB (=Ultra High Barrier) film compared with commercial films

polypropylene is the dominant material, accounting for nearly 60 %, followed by polyester with a 35 % share (Fig. 4). These market shares can vary considerably depending on region and country. In order to analyze the BO film market the following segmentation with different conditions and requirements is indicated.

- Three types of market can be defined:
- Saturated markets
 - Emerging markets
 - Developing countries

Saturated Markets

In saturated markets such as Europe, the USA or Japan the influence of relevant (demographic) growth forces is minimal. However, increasing health awareness, an aging population, growing numbers of single households, more women in employment and consumers who are increasingly looking for convenience products result in long-term stable growth rates at a low level of less than 3 % p.a.

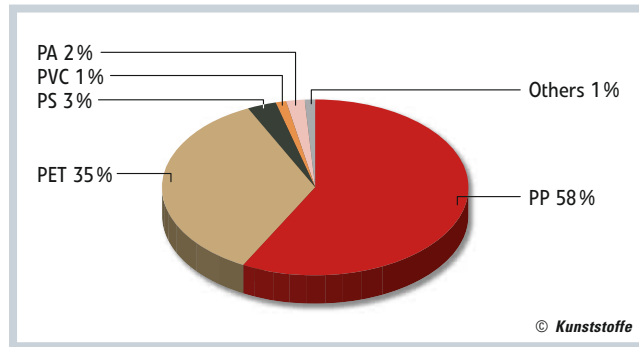


Fig. 4. Market shares of the different polymers in BO films

Standard films are increasingly imported from countries with lower production costs. Therefore film manufacturers in saturated markets are modifying their facilities to produce film with added value. Multi-layer films, specially coated films, shrink films or bio films are just a few examples.

Emerging Markets

By contrast, emerging markets in Eastern Europe, Latin America, the Middle

East and particularly Asia show growth rates above 10 % p.a. By 2013 China will overtake Japan to become the second largest packaging consumer. In India, double-digit growth rates are predicted for the coming years. Attractive growth opportunities are also expected in the Middle East and the markets of Latin America. Additional demand will be driven by the rapid growth of the middle class and the expansion of infrastructure in conjunction with a high urbanization rate.

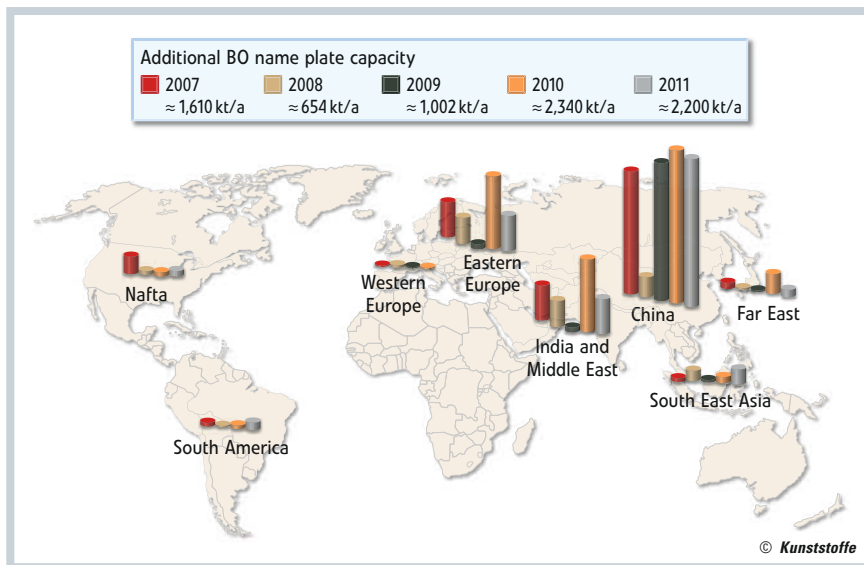


Fig. 5. Investments in new BO film capacity 2007 – 2011

Developing Countries

These regions are just at the beginning of a development which will continue for decades. Low living standards and in particular the lack of infrastructure explain why these countries are still far removed from the standard of developed countries as regards the use of plastics packaging. But in the long run there is a definite growth potential.

New investments in BO production lines in the various regions are in line with the segment-specific economic development (Fig. 5). Capacity expansion refers to the indicated name plate capacity for which the production lines were usually designed.

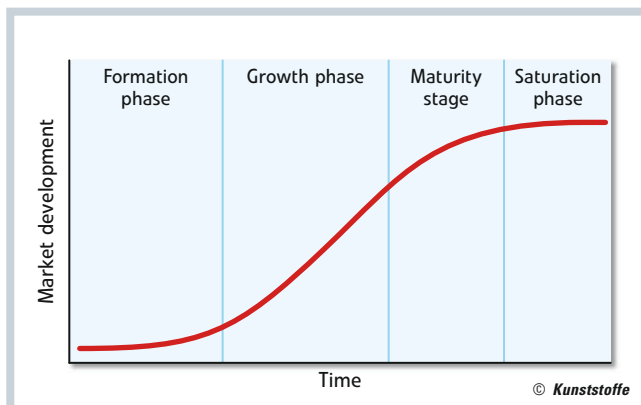


Fig. 6. Various phases of market development according to Richard N. Foster (source: Wikipedia 2012)

The Future of Supply and Demand

A comparison between the worldwide production volume of BO film on the one hand and the actual consumption on the other indicates that no overcapacity can currently be discerned within the BOPP market, despite the recent investments. The worldwide production capacity of approx. 8 million tonnes per annum in 2013 will be matched by an equivalent consumption. Since film consumption will continue to rise, there is still room for more investments.

The situation with regard to BOPET film is somewhat different. As a result of →



Fig. 7. Typical applications for technical special films in photovoltaics

the large number of lines sold in 2010 and 2011 – mostly to Asia – there will be an overcapacity from 2013, thereby limiting new investments for the next two or three years.

Such a situation is not unusual for the BO film sector, however. The after-effects of such developments always progress in a similar manner. First of all, the increased production capacities lead to a shortage of raw materials and a corresponding rise in the prices of raw materials. Then there is a decrease in film prices due to the rapid increase in supply and the slower in-

crease in demand. This means that film producers are faced with lower margins.

On the other hand experience also shows that especially in such periods the inventiveness of the members of the supply chain also increases. New applications are developed, substitution potentials with regard to other packaging materials (glass, paper and aluminium, etc.) are exploited more fully and alternative distribution channels are established. This leads to an increase in demand, a decrease in the overcapacity and rising margins for film producers, which even-

tually makes new investments attractive again.

The Future of BO Film Markets

As in many sectors of the consumer goods industry and also in the manufacturing trade, markets can be correlated with different phases. The growth phases of a market are described in Richard N. Foster's "S-curve concept" (Fig. 6).

Whereas emerging markets such as China, India, South-East Asia and Latin America are clearly in the growth phase, the USA, Europe and Japan have already reached the phase of maturity or saturation.

Saturation Phase. Will there be any European or North American film producers at all left in 20 years? The answer is an emphatic "yes"! Local film manufacturers will still be needed in the future because it is not easy to globalize film production. Moreover, converters often prefer a certain proximity to their suppliers, in line with the key phrase "supply on demand".

Region	Growth 2008–2013
China	52 %
Subcontinent India	46 %
Middle East and Africa	36 %
South America	36 %
South East Asia and Oceania	33 %
Western and Eastern Europe	14 %
NAFTA	13 %
Far East incl. Japan	9 %

Table 1. Increased capacity of BO film 2008 – 2013

The real question is who the film producers within these markets will be. In saturated markets in particular, many companies in this field are (partly) owned by private equity companies which are mainly return-driven. If the manufacture of BO film fails to provide attractive returns, shareholders may lose interest in the business and put the necessary investments on hold.

In this regard added value films offer a potential means of differentiation and market positioning. To this end, older lines which are no longer efficient can be modified. But this must also be accompanied by an increase in R&D expenditure, detailed market research and a consistent marketing strategy.

Growth Phase. How long will the above-average growth continue and are

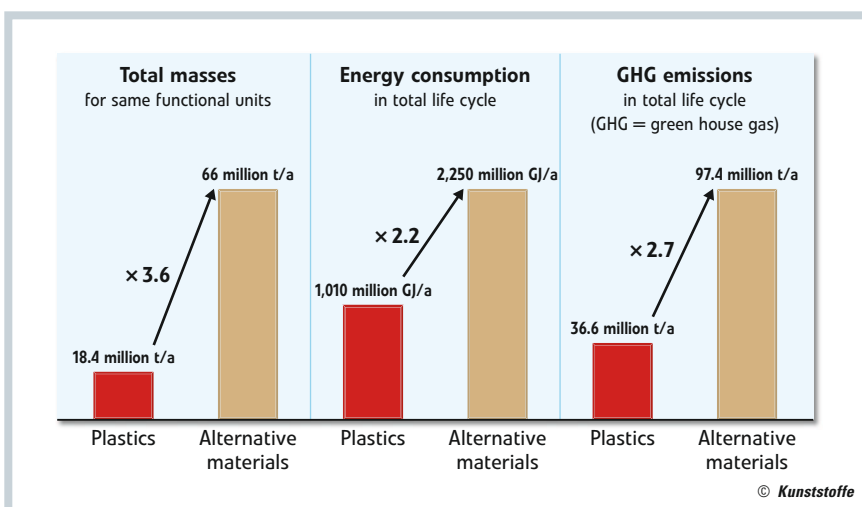


Fig. 8. If plastic packaging were replaced by alternative packaging materials, this would result in the need for 3.6 times as much total materials, 2.2 times as much energy (seen across the entire life cycle) and 2.7 times as much CO₂ emissions (source: Denkstatt Study 2011)

there any further disruptive factors which could influence future developments?

It is to be expected that growth rates in the fast-growing economies such as China and India will slow down in the medium term. However, double-digit growth rates seem likely to continue, especially in the consumer goods sector – which directly affects the packaging industry. Nonetheless, these markets will be increasingly faced with issues such as renewable energy and raw materials, sustainability, reduced carbon footprint and the tightening of environmental laws – which of course will influence the costs of film production.

Apart from China, India is one of the fastest growing economies. With a capacity expansion of approx. 46 % the country currently occupies second place in the BO film market (**Table 1**). It is interesting to note that Indian film producers are not only expanding within their own country; to date production facilities have also been established in the Middle East (Oman, UAE, Egypt), Europe (Turkey) and in the NAFTA region (Mexico). The advantages of this strategy include greater customer proximity and shorter delivery times. The

success of such a concept is proven by recent new investments made by Indian companies abroad.

New Applications

Bi-axially oriented specialty films are increasingly being used in technical applications. Fast growing markets include displays and screens, photovoltaic panels and separator films in high performance Li-Ion batteries (**Fig. 7**).

The pioneers in these markets were high-tech driven countries such as Japan and Korea. The specialty films produced there were mostly finished directly on site. The production lines were self-made, specially tailored machines. Because of the fast volume growth and the increasing cost pressure, production is increasingly being transferred to low-wage countries in South-East Asia or to China. The latter has become one of the largest producers of photovoltaic panels and flat panel displays. This shift in production sites has been accompanied by greater transparency in the production expertise; a development similar to that which took place in the past with regard to the films for the packaging market can currently be observed.

These new markets exhibit high growth rates, but the total demand for bi-axially oriented film remains relatively modest. Therefore the demand for new production lines in this sector is still quite low, although this may change rapidly over the next few years. Driven by political factors such as the trend towards renewable energy (photovoltaic panels) or electric mobility (e-car and e-bicycle), a corresponding rapid boom in this sector in the near future is possible.

Conclusion

Bi-axially oriented films are a vital part of our daily life. They are widely employed, from simple packaging to highly complex technical applications. Virtually no other material fulfils the markets' high demands better, for example regarding sustainability, as the Denkstatt study "Product Sustainability" from 2011 confirms (**Fig. 8**). ■

THE AUTHOR

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