

The Film & Coating Connection

"Spreading the News"

Issue #11

October, 2007

In This Issue Read About....

- Sustainability in Flexible Packaging
- Comparison of Cast vs. Blown Film
- Guest Article from Colortech
- Optimizing Edge Bead Reduction in Extrusion Coating
- Plastics Tech Center Celebrates 50 Years of Discovery
- Useful Internet Resources, Industry Events...and more....



Sustainability – What does it mean?

What do you think about when you consider "Sustainability"? As it relates to the flexible packaging industry, many of us think about issues relating to biodegradability, down-gauging, or disposal/recycling.



Chevron Phillips Chemical Company LP (Chevron Phillips Chemical) is one of the world's top producers of

petrochemicals used in the manufacturing of over 70,000 consumer and industrial products. As an industry leader, we are committed to promoting economic growth in a safe, secure and environmentally responsible manner. We also support our customers by offering product innovations that address market sustainability initiatives.

Chevron Phillips Chemical has expanded its view of "Sustainability" concepts to include the operation of our facilities in an energy and environmentally responsible way. A few accomplishments are listed below:

- ✚ **Global**
 - ✚ Greenhouse gas intensity (pound of carbon dioxide per pound of product) has been reduced by 18% from 2001 to 2006.
 - ✚ Energy efficiency (BTU's consumed per pound of product) has been reduced by 8% from 2001 to 2006.
- ✚ **Domestic**
 - ✚ Nitrogen oxide (NOx) emissions have been reduced by 39% from 2001 to 2006.
 - ✚ Hazardous waste sent offsite for treatment/disposal has been reduced by 75% from 2001 to 2006.

In addition, Chevron Phillips Chemical is committed to future capital improvement projects at our U.S. facilities through 2010 that relate to complying with environmental regulations and improved energy efficiencies. We are also a partner in Operation Clean Sweep and strive for zero plastic pellet loss into the environment. This integrated approach represents Chevron Phillips Chemical's commitment to "Sustainability".

Film Processes: Cast vs. Blown

The packaging industry appears to be moving towards thinner, more flexible types of packaging. These flexible packages can contain less disposable content than rigid packaging. The thin films required for flexible packaging are produced using two primary processes: blown film and cast film. Although the final products are similar, there are advantages and disadvantages to each of these film production processes.

News about the people, products, and processes in flexible packaging.

The Film & Coating Connection
Chevron Phillips Chemical Company, LP
Phone 1-800-437-2650
e-mail: theconnection@cpchem.com

Industry Events

CPP Expo 2007 – CPP Expo 2007, the premier event for the converting, printing, and packaging marketplace will be held in October 15-17, 2007 in Las Vegas. Find out more at www.cppexpo.com

PackExpo 2007 - PackExpo 2007 will focus on the latest developments and advances in packaging technology, machinery and materials. To be held October 15-17, 2007 at the Las Vegas Convention Center. Find out more at www.packexpo.com

K 2007 – K 2007, one of the world's largest trade fairs for the plastics and rubber industries, to be held October 24-31, 2007 in Dusseldorf, Germany. Find out more at www.k-online.de.

Polyethylene Films 2007 - Polyethylene Films 2007 will take place December 3-4, 2007 at the Hyatt Regency in Fort Lauderdale. This conference will provide a picture of the film industry in North America and will offer attendees an opportunity to gain knowledge of new developments and future trends influencing the industry. Find out more at www.amiplastics.com.

Polyolefins 2008 – The annual SPE International Polyolefins Conference will be held February 24-27 at the Wyndham Greenspoint in Houston. Find out more at www.4spe.org.

FlexPackCon 2008 – The Flexible Packaging Division will be holding their third topical conference on flexible packaging February 24-27 in Houston. The conference will be held in conjunction with Polyolefins 2008. Find out more at www.4spe.org.

There are two major differences between the blown and cast film processes. The first difference is the method in which the film is formed. The form is dictated by the basic shape of the die. Blown film is produced by extruding molten polymer through an annular opening to form a hot tube of polymer. In contrast, cast film is extruded through a flat die with a wide, thin opening to form a flat curtain of film. The second major difference between blown and cast film is the method of cooling the molten polymer. Blown film is cooled using chilled air blown onto the surface of the molten polymer film. In contrast, cast film is cooled very rapidly via a water cooled chill roll. The speed of cooling can greatly affect the final properties of the film products.

Blown Film Advantages

The primary advantage of blown film over cast film is “film strength”. Upon exiting the annular die, the molten tube of polymer is then stretched to a size 1.5 to 3 times larger than the die opening. The ratio of finished bubble size to die size is known as the “Blow Up Ratio” (BUR). This cross direction stretch of the molten polymer tube effects the crystalline orientation of the finished film. This cross directional orientation yields better film strength properties such as tear, impact, and puncture resistance. The cast film process allows orientation primarily in the machine direction, therefore machine direction tear, impact, and puncture resistance are not as strong as blown film.

Bubble stability is very important in the blown film process. For this reason, the blown film process requires lower melt temperatures than the cast film process. The lower melt temperatures also mean less antioxidant additives are required for blown film.

Capital cost for a blown film line can be considerably less than those of a cast film line. Although the building costs can be higher for blown film due to the film tower, the machinery cost for blown film is much less than a cast film line. Cast film machinery and auxiliary equipment such as a feedblock, chill rolls, and a chilled water system can drive the cost up.

Cast Film Advantages

The primary advantage of the cast film process over blown film is output. The superior cooling efficiency of the chill roll system allows greater production outputs for cast versus blown film.

Another advantage of the superior cooling efficiency of the cast film process is superior optics. In general, the faster a molten polymer film is cooled the better the optical properties haze, gloss, and clarity. This is the reason many high clarity film applications utilize the cast film process.

Gauge control is another important aspect of film production. Films without good gauge uniformity can cause poor roll quality and printing issues. A cast film generally has more uniform gauge than a blown film due to the short distance between the die exit and the chill roll. This short time in the “air gap” allows the molten curtain to remain very stable. The cast film die also has much finer die lip adjustment allowing better control of the overall gauge.

Retrofit to coextrusion is also advantageous to the cast film process. In general, coextrusion cast film requires less new equipment than blown film. In most cases, blown film requires a new die to go from monolayer to coextrusion. A properly equipped cast film line requires only a change in selector plug to switch from monolayer to coextrusion.

Advantages of both the blow and cast film processes are outlined below. The selection of the appropriate film process is critical to success in thin film applications:

Advantage:	CAST FILM	BLOWN FILM
Film Strength		X
Additive Loading		X
Capital Costs		X
Output	X	
Optical Properties	X	
Gauge Control	X	
Retrofit to Coex	X	

Sustainable Packaging – Packaging that meets the desires and requirement of today’s society without compromising the ability of future generations to meet their own needs. Sustainable packaging should have little to no impact on future generations.

Degradable – The ability to break down into smaller fragments or particles but not necessarily break down completely into carbon and water alone.

Biodegradable – Decomposing or breaking down into water, methane, carbon dioxide, inorganic compounds or biomass that can be broken down further by micro-organisms.

Compostable – Biodegrading and disintegrating in a compostable environment, which is an environment where aerobic organisms (aerobes) combined with the proper ratio of carbon, nitrogen, oxygen, and water are present.

Recyclable – Materials that can be reprocessed and made into new products. The term recyclable generally does not include products that can just be reused.

Did you know... that most types of plastics are considered recyclable even though most curbside recycling programs only tend to collect PET and HDPE? Did you also know that due to advances in technology that recycled plastic is showing up in products such as sub-laminate flooring, picnic tables, park benches, and decking, and that plastic lumber lasts longer than wood, does not rot or splinter, is slip resistant, and it, too, can be recycled?



Processing Tips

“The Film & Coating Connection” is pleased to offer useful extrusion coating processing tips. However, due to the complexity of production and manufacturing, these tips should be used only as rough guidelines and suggestions. Implementation of any of these processing tips could affect the finished properties of the final product and should **never** be implemented without proper safety considerations. Further, they are not a substitute for your own expertise.

Optimizing Edge Bead Settings on EBR Dies

Due to the inherent nature of extrusion coating or laminating, using a flat die with unsupported edges, and a relatively large distance between the die lips and the nip (air gap distance), neck-in occurs. Neck-in can be attributed to the elastic properties exhibited by polymers when they are drawn down, in the air gap, during the extrusion coating processes. Neck-in negatively impacts the extrusion coating process due to the fact that the thickness of the poly curtain at the edge of the poly curtain (neck-in region) can be up to 10 times the average thickness of the poly curtain. With this edge bead being trimmed from the product and essentially scrapped, it is important to reduce the amount of edge bead.

OPTIMAX Color Concentrate Additives & Blending Considerations - George Upton, Colortech Inc.

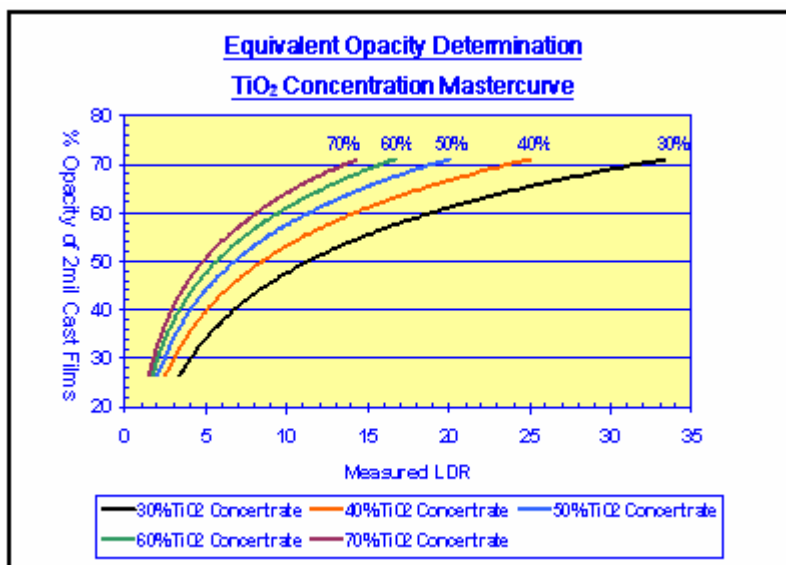
Colortech Inc. introduces a new family of color concentrates designed to bring the optimum opacity with the maximum value. These OPTIMAX products are designed to look beyond the easy answer of just using titanium dioxide (TiO₂), which provides the most opacity of any of the current minerals used in polymers. The main property that Colortech looks for in white color concentrates, is opacity, closely followed by quality of dispersion, and then comes the final issue of value, or dare we say "cost." In each case the goal is to use as little of any costly ingredients as possible and replace them with other whiteners while retaining the principal properties of opacity and performance.

It is incumbent upon the processor to be able to accurately meter and then distributively mix the selected ratios of TiO₂ and resin. At one extreme is an 80% loaded TiO₂ being used at a variety of LDR's (let down ratios) to be well incorporated by the extruder. At the other end of the spectrum is a product which has less than 30% TiO₂ and a lot of other whiteners. The 80% loaded masterbatch has to be fed ever so accurately while with the 30% product has a bit more leeway since it is used at a much higher LDR and feeders seem to handle large deliveries better than accurately metering smaller LDR's.

Another key constraint, to achieving the optimal amount of TiO₂ in the finished product, is the accuracy and type of mixer being used. Trying to ensure that you have 1.5% of an 80% TiO₂ going into a 24:1 extruder, using a volumetric system can be a challenge. There is no question that some of the volumetric feeders will approach this accuracy, however they must be well maintained and closely monitored. The consistency of pellet geometry is even more of a consideration at these high LDR's when using volumetric feeders, while gravimetric feeders have fewer issues.

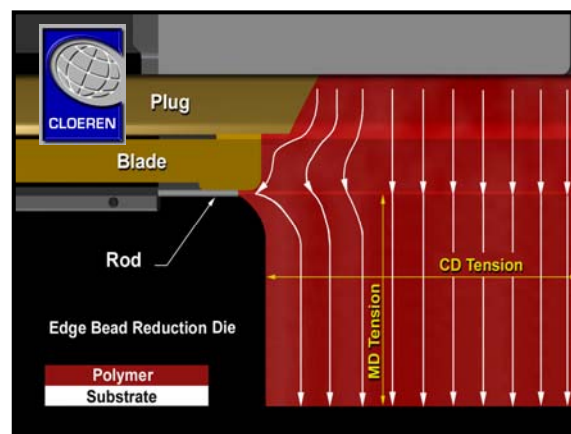
The final question, when using white color concentrate to achieve a desired opacity is, "will the extrusion system distribute the color as well as it must to minimize streaking?" As the industry has switched to extrusion systems with higher L/D's (28,30,32:1) the result has been improved mixing. Significant improvements from the beginning to the end of the extrusion system, such as static mixing devices and improved die geometry have also had an impact the final appearance of the film or coating.

The chart below show a normalized curve of TiO₂ color concentrates and compares opacity values of a 2mil cast film using color concentrate masterbatches from 30-70% concentrations.



One method used to reduce the amount of edge bead, and scrap, is to employ edge bead reduction (EBR). EBR technology is achieved by using internally deckled dies, which effectively reduces the thickness of the edge bead in the extrusion coating process. In order to get the maximum benefits of EBR, it is important to understand how EBR technology works.

EBR is achieved by mechanically reducing the mass of the poly, in the die, at the regions where neck-in occurs. The amount of EBR in an internally deckled die is controlled by the position or offset of the internal deckles. Internal decking systems are typically comprised of a plug, blade, and deckle rod, as shown below.



When the plug, blade, and rod are aligned, then the plug and blade are both set at the 0" setting. In this configuration there is no offset between the deckle rod, blade, and plug and no EBR occurs.

To increase the amount of EBR, the plug and blade must be offset from the deckle rod. To achieve this, the plug and blade must be moved or "deckled-in" to create this offset. For example, the plug might be moved into the die to create a 2½" offset from the deckle rod and the blade might be moved into the die to create a 1¼" offset from the deckle rod (similar to what is shown above). This offset between the deckle rod, blade, and plug, will reduce the mass of poly at the neck-in region and significantly reduce the thickness of the edge bead to minimize scrap.

Every type and grade of material has a unique and different flow property known as its rheological behavior. Due to these differences in rheology, every material can and will react differently to a given EBR setting. It is important to know how a particular material will react to various deckle settings in order to find the optimum EBR settings. It is also important not to reduce the edge bead to the point where the poly curtain is susceptible to edge tear. A slight amount of edge bead can protect against excessive edge tear. It is also important to remember that the "R" in EBR stands for "reduction" and not "elimination."

One simply method of optimizing EBR settings is to try various settings and obtain samples of the edge trim at each EBR setting. The edge bead can then be measured using a micrometer and the optimum setting can then be noted.

Chevron Phillips Chemical's Plastics Technical Center Celebrates 50 Years of Discovery

Chevron Phillips Chemical recently celebrated 50 years of discovery at its Plastics Technical Center in Bartlesville, Okla. With its origins as a sales service laboratory in the 1950s, the Plastics Technical Center quickly became renowned in the industry for its dedication to materials, application, and



plastics processing development for customers of Marlex® polyethylene, Marlex® polypropylene, Ryton® polyphenylene

sulfide, and K-Resin® styrene butadiene copolymer. The Plastics Technical Center continues to play a key role in product innovation as well as educating customers and sales personnel in the use and processing of Chevron Phillips Chemical's plastics.

"For the past 50 years, Chevron Phillips Chemical's Plastics Technical Center has been at the forefront of turning concepts into real products," said Mary Jane Hagenson, Vice President of Research and Technology.

Over the years, many innovative milestones were reached at the Plastics Technical Center, including the co-development of the first successful plastic detergent bottle, bleach bottle, baby bottle, automotive fuel tank, and two-liter bottle closure. The Plastics Technical Center was also instrumental in processing innovations such as moving section molds for blow molding, die shaping for blow molded parts, insulated runners for injection molding, and fusion technology for polyethylene pipe.

"From the hula hoop to substrates for printed circuit boards, the Plastics Technical Center has played an integral role in bringing our research and development group, manufacturing facilities, and customers together to create commercial successes in the marketplace," Hagenson said.

With state-of-the-art laboratories and processing equipment, the Plastics Technical Center offers potential and existing customers access to resources useful in developing and testing cutting-edge products. Existing customers also receive on-site technical support when needed to troubleshoot processing issues.

"The clock is already ticking on our next 50 years and Chevron Phillips Chemical is excited about continuing to provide world class technical service to our customers," said Hagenson.

DISCLAIMER

Before using the product, the user is advised and cautioned to make its own determination and assessment of the safety and suitability of the product for the specific use in question and is further advised against relying on the information contained herein as it may relate to any specific use or application. It is the ultimate responsibility of the user to ensure that the product is suited and the information is applicable to the user's specific application.

Chevron Phillips Chemical Company LP does not make, and expressly disclaims, all warranties, including warranties of the merchantability or fitness for a particular purpose, regardless of whether oral or written, expressed or implied, or allegedly arising from any usage of any trade or from any course of dealing in connection with the use of the information contained herein or the product itself. The user expressly assumes all risk and liability, whether based in contract, tort or otherwise, in connection with the use of the information contained herein or the product itself. Further, information contained herein is given without reference to any intellectual property issues, as well as federal, state, or local laws, which may be encountered in the use thereof. Such questions should be investigated by the user.

© 2007 Chevron Phillips Chemical Company LP

Internet Resources

Plastics News - www.plasticsnews.com is a supplement to the weekly newspaper "Plastics News" and is updated daily with the breaking news that covers all segments of the plastics industry from automotive to flexible packaging.

Converting Magazine - www.convertingmagazine.com covers the latest news and developments for those converting and printing paper, paperboard, plastic, film, and other materials.

Chemical & Engineering News - C&EN online supplements Chemical & Engineering News magazine and covers science and technology, business and industry, government and policy, education, and employment aspects of the chemistry field. Check out www.pubs.acs.org/cen/index.html

Important Contact Information

Chevron Phillips Chemical Company Sales and Technical Service Contact Information:

Polyethylene Film & Coating Technical Service (800) 437-2650

ext. 6137 Jim Addcox – F&C Tech Service Supervisor
ext. 6121 Clint Cleaver – Ext. Coating Tech Service
ext. 6315 Kelly Frey – Ext. Coating Tech Service
ext. 6391 Darrell Landry – Film Tech Service
ext. 6136 Doug Mills – Film Tech Service
ext. 6193 James Solis – Film Tech Service
ext. 6126 Connie Sonnier – F&C Admin. Assistant
ext. 6322 Larry Szmuto – Film Tech Service
ext. 6137 Rick Wagner – Film Tech Service

Polypropylene Film & Coating Technical Service (918) 661-0519 Bill Bridendolph

K-Resin® SBC and Polystyrene Film Technical Service

(740) 374-0262 Jack Frost

Sales and Customer Service

(800) 231-1212

Need datasheets, MSDS, or more information on Chevron Phillips Chemical's products, services, and capabilities? Visit us on the Web at www.cpchem.com.

Feedback

To unsubscribe or to let us know what you think about this newsletter please e-mail theconnection@cpchem.com