The Film & Coating Connection

"Spreading the News"

Issue #12 ***July, 2008***

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New President and CEO of Chevron Phillips Chemical Company, Greg Garland

Chevron Phillips Chemical Company LLC's (Chevron Phillips Chemical) Board of Directors has elected Greg Garland as President and CEO, replacing Raymond I. Wilcox, who is retiring.

Garland has extensive experience in the chemicals industry within the company itself and with one of Chevron Phillips Chemical's shareholders. Before his election to President and CEO, Garland served Chevron Phillips Chemical as Senior Vice President, planning & specialty chemicals. His prior experience also includes serving as general manager of Qatar/Middle East for Phillips Petroleum Company (now ConocoPhillips), a position he was named to in 1997. From 1995 to 1997, he served as general manager of natural gas liquids after serving as manager of planning and development in planning and technology. From 1992 to 1994, Mr. Garland was manager of the K-Resin® business unit.

Garland began his career with Phillips in 1980 as a project engineer for the Plastics Technical Center. Between 1982 and 1986, Garland worked as a sales engineer for Phillips' plastics resins and from 1986 to 1988 was a business service manager for advanced materials. From 1988 to 1989, he was business development director in Bartlesville, Oklahoma. In 1989, he became olefins manager for chemicals.

Garland received a Bachelor of Science degree in chemical engineering from Texas A&M University in 1980. He is a member of the Chemical Engineering Industrial Advisory Board for Texas A&M University.

To hear more from Greg Garland or to learn more about Chevron Phillips Chemical's leadership team, check out www.cpchem.com/enu/leadership_team.asp

Coefficient of Friction – COF

Coefficient of Friction (COF) is a term commonly used in film and extrusion coating to describe surface frictional properties. Details of the test methods and apparatus are outlined in ASTM-D1894. Two COF values are obtained from this test method that describe these frictional properties. Static COF is the force required to initiate movement between two surfaces, while kinetic COF is the force required to sustain this movement. Both are useful in determining acceptable frictional properties in packaging applications.

As with COF, the term "slip" is also commonly used to describe the frictional properties of structures. Care must be taken when using these terms because, as qualitative descriptions of friction, they have the opposite meaning. The

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

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Industry Events

Sustainable Packaging Forum – The 2008 Sustainable Packaging Forum will be held September 9-11, 2009 at the Denver Marriott Tech Center. Visit www.bnpevents.com for more information.

TAPPI Place Conference – This year's TAPPI PLACE Conference will be held September 14-17, 2008 at the Renaissance Portsmouth Hotel Waterfront Conference Center in Portsmouth, Virginia. Visit www.tappi.org for more information.

Stretch & Shrink Film 2008 – The Stretch & Shrink Film 2008 business conference and exhibition will be held October 14-17 at the Atlanta Marriott Marquis. Visit www.amiplastics.com for more information.

AIMCAL Fall Technical Conference – The AIMCAL Fall Technical Conference 2008 will be held October 19-22, 2008, in Myrtle Beach, South Carolina. Visit www.aimcal.org for more information.

PackExpo 2008 – PackExpo 2008 will be held November 9-13, 2008 at McCormick Place in Chicago. Visit www.packexpo.com for more information.

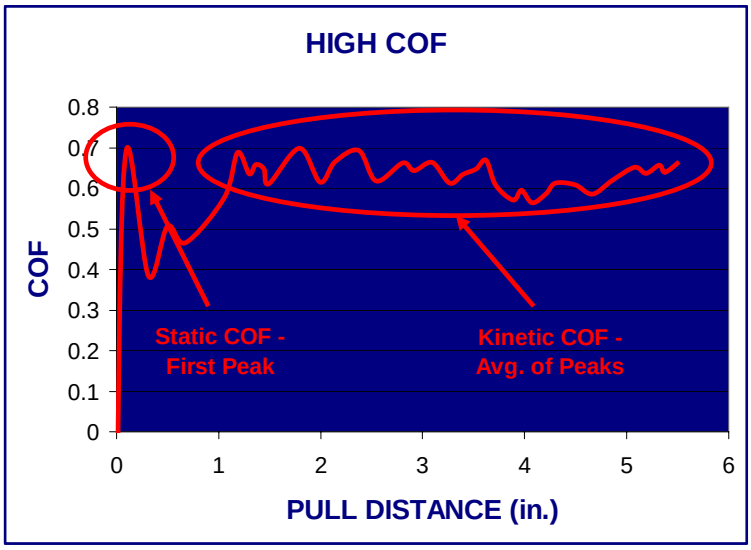
CPP Expo 2008 – The Converting Packaging & Printing Expo co-located with PackExpo at McCormick Place in Chicago November 9-12, 2008. Visit www.cppexpo.com for more information.

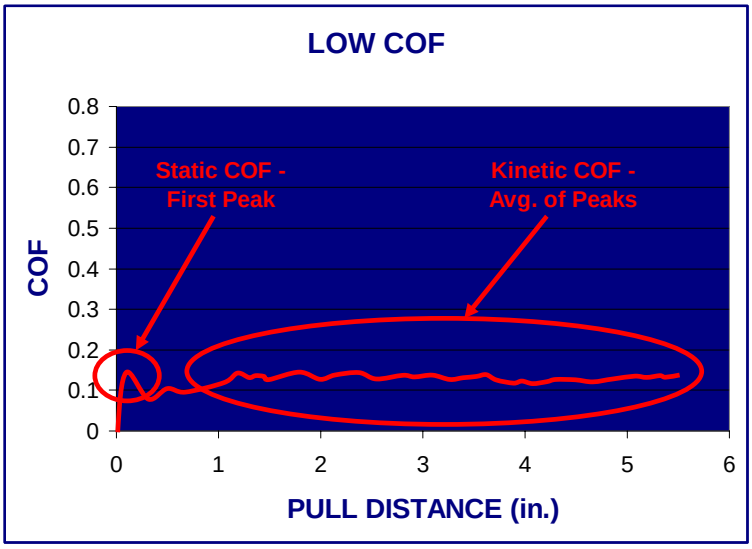
NPE 2009 – The 2009 National Plastics Exposition will be held June 22-29, 2009 at McCormick Place in Chicago. Visit www.npe.org for updates. Be sure to make your hotel reservations early!

following table breaks COF and slip descriptions into the three general categories most often used in purchasing specifications for packaging structures.

COF Categories		
Low COF	High Slip	<0.25
Medium COF	Medium Slip	0.25 – 0.45
High COF	Low Slip	>0.45

COF is important in packaging for a variety of reasons. Some of these reasons include the easy opening of packages, easy insertion of contents into a package, and allowing filled bags to stack without sliding during palletization or transport. COF is critical for a variety of other reasons but without proper COF, packaging lines can quickly grind to a halt. Typical COF curves for high and low COF structures are illustrated in the following charts:





Many additives affect COF properties. Besides being a descriptor for COF, the term slip also refers to the most common additive used to alter COF. One of the most common types of slip additives used in film and extrusion coating resins is erucamide. Other chemicals are also used, but erucamide is the most effective and offers excellent shelf life.

Slip is basically incompatible with the polyethylene matrix and migrates to the film surface after extrusion. The layer of slip on the film surface results in a slick layer that lowers COF and allows surfaces to easily slide against each other. The amount of slip on the surface depends primarily on the concentration of erucamide in the resin (ppm) and the thickness of the film or

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.

Use of Infrared Thermography to Optimize Extrusion Processes

Infrared thermography or thermal imaging is an excellent tool that can be used to measure and optimize extrusion coating and film processes. This invaluable tool can be used for everything from detecting deteriorating electrical components and conditions, such as faulty breakers or loose electrical connections, to accurately measuring extrudate melt temperatures and extruder temperature zones.

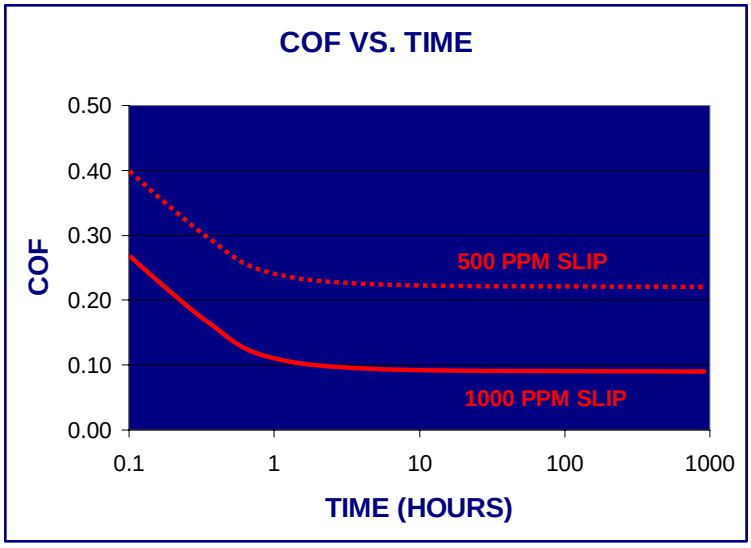
Thermography involves the use of sensitive and accurate cameras that can detect radiation in the infrared range of the electromagnetic spectrum. As an object is heated it generates infrared radiation. The camera not only measures the infrared radiation, but can distinguish subtle variations. For example, the thermograph shown below of a feedblock on Chevron Phillips Chemical's extrusion coating pilot line shows a temp of 551°F, near the center of the feedblock, where the crosshairs are located. The hottest spots of the feedblock are the white areas where the temperature is 641°F. The coolest spots of the feedblock are the wires (shown in purple) at 216°F.

One of the most effective uses of thermal imaging in extrusion is to use it to measure the melt quality of the extrudate. Simply put, this means measuring the melt temperature gradient (ΔT) across the melt stream of an extrusion system. Too broad of ΔT means that the polymer is subjected to many different temperatures resulting in varying degrees of rheological (viscosity related) properties. A broad ΔT can result in many different quality related issues. For example, the hottest material (lowest viscosity) will flow through the feedblock and die and seek the "path of least resistance" and may flow to the part of the die with the largest die opening, resulting in gauge bands.

A broad ΔT also means that there is a large variation in melt temperature across the web which can result in inconsistent adhesion in extrusion coating. Issues in film from a broad ΔT will result in poor gauge control.

seal layer (gauge) of a structure. High levels of erucamide provide more slip to exude to a film surface at a given gauge. Thicker film allows more of the erucamide to exude to a film surface by virtue of greater cross-sectional area.

Low COF induced with a slip additive is also time dependent. After extrusion, there is a time lag during which the slip migrates from the polyethylene matrix to the surface. Ultimately, the amount of slip additive on the surface reaches a steady state and COF remains constant. This migration is illustrated in the following chart:



Other factors also influence COF. Antiblock additives can reduce COF as they create a "ball bearing" effect between the film layers. They can also increase COF as they can absorb slip depending on their oil absorption properties. Corona treating can either raise or lower COF depending on the level of treatment and other additives present in the film. Antistats, inks, varnishes, and adhesive can also alter COF properties.

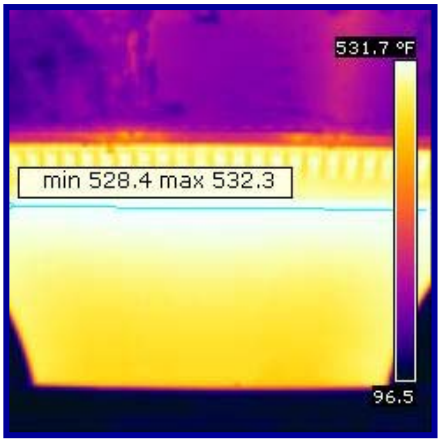
A considerable amount of time must be spent designing a packaging structure to ensure that the product meets the COF needs of the end user. One must ensure that any secondary processes or additives in the resin do not adversely affect the target COF of the structure, not only fresh off the extrusion line but after the film is allowed to "cure".

Extruder Barrel Borescoping
Timothy W. Womer Xaloy Corporation

One of the most important maintenance processes in an extrusion facility is the bore measurement and alignment of the extruder barrel. This is typically done by means of borescoping, either optically or with lasers. Most Original Equipment Manufacturers (OEM) either use alignment bars or borescoping during the assembly of the new extruder. Typically for small extruders, from 1.5" to 3.5" diameter, the alignment bar method is used. In most cases, when a new barrel is installed or if for some reason the existing barrel is removed and re-installed for any extruder that is larger than 2.5" in diameter, the extruder should be aligned. If an existing barrel is being aligned, then the bore should be measured to determine if there is any wear to the bore and where the wear is located so that this information can be used during the alignment process.

One of the most important parts of the barrel aligning process that is often not considered is that the thrust bearing in the extruder gearbox must be pre-loaded before a proper alignment can be done. If the thrust bearing is not pre-loaded then the drive quill can possibly sag or droop downward on the thrust

The thermograph shown below is of the melt curtain and die on Chevron Philips Chemical's extrusion coating pilot line. In this particular case, the melt quality is very good as the ΔT is very low at +/-2°F. In this instance, the melt temperature is measured while the extruder is off-line but running at processing RPM. It should be noted that the ΔT will be narrower at lower rpm's, for example if the thermal image was captured while running the extruder at drool rpm.



Even though thermal imaging is an excellent tool for measuring melt quality, it is still recommended that the ΔT be measured in conjunction with a variable depth melt probe and the data from both techniques be used to measure overall melt quality.

Other examples where thermography can be used in extrusion are to measure chill roll temperature to look for "hot spots" on the chill roll, to measure exit web temperature on dryers to ensure that the substrate is dry for priming applications, and temperature measurement of the feed throat cooling jacket of the extruder.

Internet Resources

Google Patent Search – You can now search and view over 7 million USPTO patents with Google. Check it out at www.google.com/patents

Flexible Packaging Magazine – View one of the leading publications of the flexible packaging industry online at www.flexpackmag.com

USM Polymer Macogalleria – The University of Southern Mississippi is a great place to learn the basics of polymers. Visit http://pslc.ws for more information. They also have a "kids version" suitable for middle school students at http://pslc.ws

Chevron Phillips Chemical eService Center – The Chevron Phillips Chemical's eService Center offers real time access to customer data through a secure Internet connection. Place and track your orders, obtain account information, print technical documents anytime day or night at www.cpchem.com

Dr. Randy Pausch Time Management – Dr. Pausch's current circumstances have made him an authority on time management. Check out Dr. Pausch's inspirational and pragmatic lecture from the University of Virginia entitled "Time Management" at www.dowload.srv.cs.edu or www.viddler.com

bowl end of the gearbox. Therefore, some sort of support or pre-load mechanism must be used to insure that the drive quill is properly centered to the gearbox assembly.

Once the drive quill has been centered, then the alignment process can begin. The most preferred method of borescoping is the use of an independent tripod to hold the optical scope or laser equipment. Some individuals use the method of directly mounting the scope or laser to the backside of the drive quill. This method has the advantage of the scope being in-line with the bore of the drive quill if the extruder is out of level. However, with the scope or laser attached directly to the extruder gearbox, it has the disadvantage of being influenced by the extruder. Therefore, having the scope or laser mounted on an independent tripod arrangement and away from the extruder can negate any influence from the extruder.

Once the scope or laser has been zeroed into reference of the drive quill bore, the feed throat and barrel can be measured for alignment to the drive quill of the gearbox. A moveable target should be used which can be transported easily from end to end of the extruder barrel bore. In doing so, the barrel may need to be adjusted so that the barrel is within 0.002"/foot over the length of the barrel in both the "X" and "Y" axis.

For example, a 3.5" x 30:1L/D extruder will have a barrel that is approximately 96" long, therefore, at 0.002" / foot of barrel length; the barrel should be aligned to within 0.016" in both the "X" and "Y" axis. If by chance the barrel is out of tolerance by more that the designated amount, then the front barrel support screws may need to be adjusted or brass shim stock may need to be installed in the proper locations to improve the barrel bore alignment.

In conclusion, a properly aligned barrel will help reduce screw and barrel wear, possibly decrease unexplainable elevated melt temperature or zone override, or even possibly screw shank to drive quill misengagement. All of these benefits will improve the overall life expectancy of the extrusion equipment and reduce maintenance requirements.

Laboratory Safety Suggestions

Every laboratory is unique, carrying out a wide variety of test procedures. The one feature that all labs have in common is the need for safety. We all share the desire to come to work in one condition and leave in that same condition! These are some general lab safety guidelines:

- **Wear Proper PPE** – Use the proper personal protective equipment for the job. Safety glasses, goggles, and ear protection keep you safe from painful and preventative injuries!
- **Use Material Safety Data Sheets** - MSDS should be available for every material used in a lab. Read these and follow the recommendations for safe use and disposal of the material. These sheets have a tremendous amount of information concerning the material you are about to use.
- **Be Careful When Mixing Chemicals** - Always know what to expect when you are mixing chemicals or additives. Recognize potential chemical reactivity hazards in the lab to prevent reactive chemical incidents.
- **Dispose of Chemicals Properly** – Dispose of used or unwanted chemicals properly by determining which chemicals may be hazardous, reactive, or flammable. Never casually pour chemicals down the sink. Instead dispose of chemicals in proper, labeled containers. Always be cognizant of "hidden chemicals" such as chemicals in equipment and machinery, such as batteries, refrigerant, oils, inks, toners, etc, and dispose of properly.

Industry Glossary

Borescoping – The precision alignment of the extruder barrel to the extruder gearbox to ensure the optimal performance of the extrusion system and minimal wear on the gearbox.

Thrust Bearing – A rotary bearing designed to handle high axial loads. In extrusion the thrust bearing handles the axial load or thrust from the extruder screw and is located between the barrel and the gearbox.

B10 Life – The expected life of nine out of ten bearings at a given condition. B10 life is used to determine the expected life of thrust bearing on extruders.

Important Contact Information

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ext. 6137 Jim Addcox – Tech Service Supervisor
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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 Szmutko – Film Tech Service

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