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Diagnosing and solving quality control issues is key to improving the converting process. This eBook provides converters with resources to help increase productivity, and achieve superior product appearance while maintaining consistency in quality control.

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SURFACE TREATMENT

There's More than One Way to Treat a Film

By **Ted Lightfoot**, casting, coating, drying and laminating film consultant

To most people, surface treatment means corona treatment. Corona treatment is the most popular surface treatment for good reasons, but it isn't the only choice. Table 1 lists 10 other ways to improve wetting and adhesion. But, before getting into the "how," you need to establish the "why" ... Are you looking for better wetting or better adhesion?

Printers need to control dot size, so they have to control wetting. Usually that means "surface energy" although liquids

can be pinned by roughening the surface. Abrasion to enhance roughness is not common, but buying rougher film is.

Most people use "dyne pens" containing mixtures of 2-ethoxyethanol and formamide (specified in ASTM D-2578-04a) to see which wet (for three seconds) and which bead up. Contaminated dyne pens can give false reading, so be careful what they touch.

The ASTM method (drops of liquid on clean swabs) is a better

choice if contamination is an issue. D-2578 was written for polyethylene and polypropylene. ASTM D7490-13 was written for more polar substrates (like polyester). There are small portable measuring devices for D7490 — but no pens.

Coaters need the liquid to wet the surface, but they also need adhesion. The most robust mode of adhesion is covalent bonding, so they try to introduce reactive groups on the surface (which, coincidentally raise the surface energy). Most techniques listed in

| TECHNIQUE | PRINCIPLE | CHEMISTRY | AVAILABILITY |
|-----------------------|--|--|---|
| Corona | Electric discharge ionizes air | Oxygen compounds | Most common |
| "Atmospheric plasma" | Electric discharge in gas other than air | Customizable including nitrogen groups | Increasingly common |
| Traditional plasma | "Fourth state" = electrons / ions | Wide range | Well known. Off-line |
| Plasma polymerization | Polymerization of monomers in a plasma | Variable | Uncommon |
| Abrasion | Increases surface roughness / pinning | None | Rare |
| Flash blasting | Rapid heating /cooling gives amorphous layer | None | Two recent entrants |
| Flame treatment | Pass web under flame | Oxidative/ reductive | Common for polyolefins, Mostly off-line |
| Chemical etching | Pass web through reactive bath | Customizable, Sodium / naphthalene most common | Common in fluoropolymers |
| Ozonation | Ozone chamber | Oxidation of melt | Polyolefin melts |
| Priming | Coat "tie layer" | Customizable | Common for film lines |
| Coextrusion | Extrude adherable surface layer | Customizable | Common for film lines |

Table 1 – Ways to enhance wetting /adhesion

Table 1 are aimed at improving adhesion through introducing reactive groups.

One exception to that is “flash blasting” — developed for polyester. It is hard to stick to crystalline materials. Exposing the film to a “flash” of intense light quickly melts the surface leaving an amorphous adhesion promoting layer.

In both corona and atmospheric plasma treating, the web passes between a grounded roller and an electrode driven at a high frequency and voltage. This produces a glow discharge over the film.

In air, this discharge produces reactive oxygen species (including ozone — that you have to decompose before venting). Either the electrode or the grounding roller must be insulated to prevent arcing. Before corona, people used “spark treatment” or “electronic discharge” to enhance wetting and adhesion. The great innovation for corona treatment was increasing the AC frequency from 50-60 Hz to 20-80 kHz [US Patent 3,514,393] (although most corona treaters run between 15 and 25 kHz).

Atmospheric plasma frequencies usually run between 40 and 100 kHz although some use 13.56 MHz or 2.45 GHz. The advantages of higher frequency are “depth” of the treatment (for plasma, that can include removing a weak boundary), minimization of the possibility of “lightning bolts” (point discharges that leave pinholes in the film) and back side treatment (generating a plasma on the back side of the film under a wrinkle).

Atmospheric plasma treaters use gases other than air and can produce many types of surface chemistry (e.g., nitrogen groups) as well as the oxygen containing groups generated by corona [US

Patent 3,274,091 predates the term “atmospheric plasma” by some decades, but describes many atmospheric plasma systems.].

There is a lot of confusing marketing for atmospheric plasma and “plasma ready” corona treaters. If you are considering atmospheric plasma, be clear what you are getting: Is this just a corona treater with gas seals; How high is the frequency? How much of the web path is covered by the plasma? What gases can it handle? How effective is it for surface cleaning, etc. Engineers tend to favor the highest performance system, but the least expensive one may satisfy your needs.

It has been known since the late 19th century that low pressure plasmas can react with surfaces and form new materials (including polymers) [The Foundations of Vacuum Coating Technology, Donald M. Mattox Berlin Heidelberg: Springer Verlag (2003)]. Vacuum plasma is powerful, but not an on-line option. Reactive atmospheric plasma treaters [US Patent 6,118,218] became available around 2000. These can create a wide range of chemistries and substrates — at a cost.

Another off-line option, very effective for halogenated polymers, is chemical etching (running film through a bath of metallic sodium in naphthalene).

Flame treatment involves passing the film (quickly) under a flame with a controlled chemistry. Like plasma treating, flame treating can clean off weak boundary layers. Flames can be run oxygen rich, or fuel rich to adjust the surface chemistry for the application. Flame treatment is usually run off-line; however, on-line flame treatment is common for BOPP lines. It is not

cheap to install and it presents safety challenges, but it is very effective and often produces longer treatment life than corona.

The last three techniques in Table 1 are not exactly surface treatments of the film: ozonation involves exposing the melt in an extrusion coater to ozone to introduce reactive groups on the melt. Priming and coextrusion are usually practiced before the film comes to the converter.

If done as an add-on, priming is expensive. But many film manufacturers use coextrusion and on line-priming to produce a more wettable and adherable base (quite economically). Sometimes the cheapest option is to get someone else to do it.

Which surface treatment is “best?” Usually, the cheapest one that works for your application. On-line corona treatment is usually the lowest cost option and works for most systems. It is hardly surprising that corona is the most common method. Corona does not work for all systems but if it doesn’t, remember: You have other options.

¹ US Patent 3,514,393

² US Patent 3,274,091 predates the term “atmospheric plasma” by some decades, but describes many atmospheric plasma systems.

³ The Foundations of Vacuum Coating Technology, Donald M. Mattox Berlin Heidelberg: Springer Verlag (2003)

⁴ US Patent 6,118,218

ABOUT THE AUTHOR

Ted has worked in coating, drying, laminating, and film casting for over 35 years. He has experience in R&D, plant support, as a Six Sigma Black Belt for Growth, and application development (helping customers develop processes and structured products). He is a consultant, writer, speaker, and gives short courses. He can be reached at TedLightfootLLC@gmail.com.

STATIC CONTROL

Static Measurements Guide Problem Solving

By Dr. Kelly Robinson, Founder, Electrostatic Answers

How do we solve static problems? What is the root cause of the problem?

Finding a static problem is easy. Operations run smoothly and efficiently when there is no problem. We have a problem when static damages the product (quality defect), causes a material jam (downtime), shocks an operator (injury) or ignites a fire (very bad!).

Finding an effective solution for a static problem is hard. The sage advice is to attack the root cause. I've heard this advice many times in problem-solving lectures and seminars. Finding the root cause is the hard part. How can we find the root cause of a static problem?

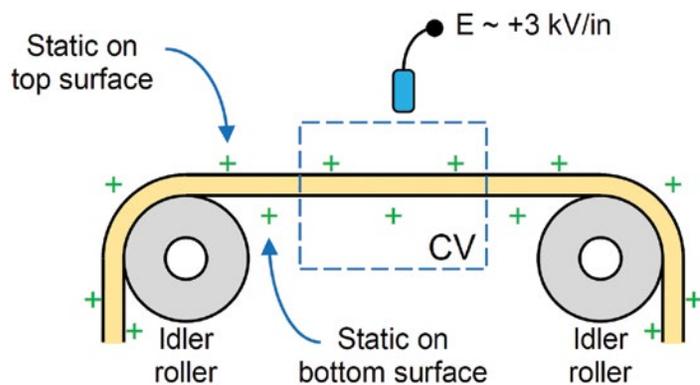


Figure 1 Measure static on a span midway between idler rollers

The material flow in many production operations is long, complex and typically crosses organizational boundaries. When the material is polyethylene (PE), polypropylene (PP), polyethylene

terephthalate (PET) or another electrically insulating material, static charges on the material persist through many operations and through transportation between operations. Because static charges

| ZONE | STATIC READING (KV/IN) | COMMENTS |
|--------------------------|------------------------|--|
| Green – Low Static | $E < \pm 5$ | Static problems are unlikely |
| Yellow – Moderate Static | $\pm 5 < E < \pm 15$ | Static problems possible. Improve static control |
| Red – High Static | $\pm 15 < E$ | Sparks occur. Static problems are likely. |

Table 2 Static Stoplight Levels

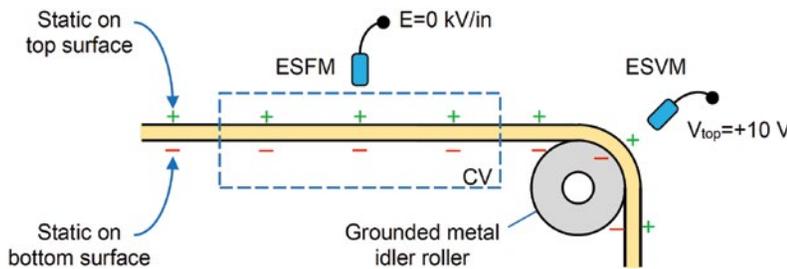


Figure 3 The web has balanced charges. The ESFM reads 0 kV/in while the ESVM indicates positive static on the top surface.

persist for so long (sometimes weeks or months) on insulating materials, the root cause may be far upstream of the problem, perhaps even in another country.

Find the root cause of a static problem by completing a static survey, which is a series of static measurements along the material flow in your operation. Use the handheld electrostatic fieldmeter (ESFM) in Figure 1 to read static on a web span midway between two idler rollers. The electrostatic fieldmeter responds to all of the static charges inside control volume CV. Since there are 3 positive charges inside CV, the reading will be +3 kV/in.

An electrostatic fieldmeter (ESFM) measures the average static over a relatively large area of the web that is typically a 4-inch diameter circle (or larger, depending on the measurement location) on the web. To make reliable, repeatable measurements, follow the

three “GeeZE Rules” (see [Static Beat | ‘GeeZE’ Rules for Static Readings](#))*.

Most static meter display the voltage in kilovolts (kV). Convert the voltage into the nominal electric field by dividing the displayed voltage by the distance from the sensor to the web (see [Static Beat | Assess Static Risks Using Electric Fields](#)). Use the static stoplight levels in Table 2 to evaluate your readings.

Static problems are unlikely when readings are low. Good static control systems keep measured levels in the **Green – Low Static** zone. As you move along the material flow, when you see a reading jump into the **Red – High Static** zone, you have found a root cause, which is a significant source of static charging. Install a static dissipater to bring the reading down into the **Green – Low Static** zone.

If static is high on incoming materials, the root cause of

the problem is upstream of your operation. While we will certainly do our best to deal with this delivered static, talk with your supplier about attacking the problem at the root cause in their operation. Ask your supplier to track the static performance of their operation by auditing static on their finished goods before shipping them to you. This will ensure that problem-free materials are delivered to you.

Unfortunately, our electrostatic fieldmeter readings cannot find the root cause of all static problems. High static on winding and on unwinding rolls may be caused by balanced charges on the web in Figure 3 where there are positive static charges on one surface of the web and there are an equal number of negative charges on the other surface of the web. The electrostatic fieldmeter (ESFM) responds to all of the charges inside control volume CV, so it reads 0 kV/in. The electrostatic voltmeter (ESVM) responds only to the charges on the exposed surface, so it indicates positive charges on the top surface.

Use an ESVM to measure the static on one surface of the web at the beginning of the material flow in your operation. Then, measure static again on the same surface near the end of your material flow. With good static control, the voltage on the surface should increase no more than $\pm 0.5 \text{ V/mm}$ ($\pm 10 \text{ V} / 0.001 \text{ inch}$) of web thickness.

Perform a static survey to find the root cause of a static problem. Once we find the source of static charging, we know where to install a static dissipater to solve the problem. ■

For more information, contact: Kelly.Robinson@ElectrostaticAnswers.com.



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Best Practices in Web Guiding

Simple factors can be overlooked, such as proper sensor placement, that is essential for optimal web guide performance which will cause guiding problems. This article reviews correct sensor placement for the four common types of web guides and ways new technology has made it easier get it right.

Typically, webs are guided relative to one edge (edge guiding), both edges (centerline guiding), printed line, contrasting pattern, or an object on the web (line/object guiding).

Unwind guiding

Best practice for unwind guiding places the sensor just after the last shifting idler roller with sensor(s) in the first 1/3 of the exiting web span. If using line/object guiding, use shifting exiting roller to back-up the web to ensure web flatness and maintain proper focal distance from the sensor.

Positive Displacement Guides (PDG)

Also called offset pivot guides or displacement guides, best practice sensor placement is in the first 1/3



of the exiting span. Many PDGs are manufactured with integral sensor mounting. To maintain proper focal distance, a back-up idler roller in the exiting span is required when line/object guiding. The back-up roller and line/object sensor should be located as close as possible to the exiting roller of the guide. The back-up roller must deflect the web enough to avoid changes in the web plane during steering but not so much that it impedes the steering motion.

Single and Double Roll Steering guides

Less common than the PDG type, steering rolls also require the sensor in the first 1/3 of the exiting span. To maintain proper focal distance a back-up idler roller in the exiting span is required when line/object guiding. The back-up roller and line/object sensor should be located as close as possible to the exiting roller of the guide. The

back-up roller must deflect the web enough to avoid changes in the web plane during steering but not so much that it impedes the steering motion.

Rewind Guiding

Sensor placement in rewind guiding is often done incorrectly. Sensor(s) should be placed just before the last fixed idler roller in the process and must move with the winder. Essentially, the winder is “catching” the web as it exits the last roller. For line/object guiding, the sensor also must move with the winder; the last fixed roller is typically used as the back-up. Because it can be difficult to link the sensors to the winder, new sensors with large detection ranges can allow stationary sensors to work in rewind applications.

Following these simple rules will allow your web guides to do their job of eliminating scrap and maintaining quality.

Contact Info:

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The Importance of Roll Cleaning and Maintenance

A question-and-answer with Joe Walczak, President of Sonic Solutions.

What are the main types of roll cleaning methods and the differences between them?

Walczak: There are really three types of cleaning processes in the marketplace: wash/blasting, laser and ultrasonics methods.

With wash/blasting methods you're taking a cleaning solution or other particle like sodium bicarbonate and forcing it under high pressure against the roll. The hope is that the pressure will chip or wash away built up dirt. These systems are typically big, bulky and expensive. With bicarbonate blasting systems you need to be careful about the white powdery substance getting all over the plant in case of a leak in the pressure system. They're not that common anymore.

Laser cleaners basically burn dirt and debris off the roll. At these high temperatures, contaminants are basically evaporated off and turned into dust. These systems are the most expensive in the marketplace and have a good niche with the largest of anilox rolls – 7 feet or longer – as well as rolls that don't come off the press easily. Repairs to these systems can be quite costly due to the type of technology used, easily exceeding \$100,000.

Ultrasonic systems have evolved into a great way to thoroughly clean anilox rolls. The cleaning solution works to soften debris in the cells of the anilox and then the ultrasonics gently and safely vacuums dirt off the anilox. Ultrasonics is a proven technology used in numerous industries where precise cleaning is needed and required, such as, hospital operating rooms, NASA and the space industry. It's a simple but effective way to clean an anilox. Ultrasonic cleaning systems for anilox rolls vary in cost depending on size of rolls. They can range from under \$10,000 for small 16-inch anilox rolls to under \$40,000 for a 72-inch sleeve.

What problems are associated with inconsistent or improper roller maintenance and cleaning?

Walczak: Maintaining an anilox roll is of great importance. Every label company has as its highest priority to get label customers, print labels and keep that customer coming back. Maintaining your anilox rolls won't necessarily help get customers, but it can impact printing labels and keeping customers.

The anilox roll is one of a few factors with a direct impact on labels. If an anilox is dirty then it's not delivering the right amount of ink to the label. That will impact colors. If press operators aren't getting the right density of color, then



that press is running bad labels or sitting idle while the operator is hunting for the problem. Those bad labels and idle time cost the company money. Using clean anilox rolls each time a press is set up to run a job will be one big headache operators will avoid. Keep your rolls clean!

What solutions can your company provide to address these problems?

Walczak: Well that's specifically what Sonic Solutions provides. For over 20 years we've provided quality, durable, safe and inexpensive cleaning alternatives for anilox rolls. Thousands of customers throughout the world rely on our equipment daily to keep their anilox rolls clean. Some larger customers have several units side by side with rolls going on and off the system all day long. They'll clean rolls after every press run so they know colors will come out right on target each time.

What key factors should converters keep in mind when choosing roller cleaning solutions?

Walczak: When seeking a solution to keep anilox rolls clean, consider lots of factors: Reliability. Safety for your anilox. Price. Ease of use. What have your operators used in the past? And service.

Sonic Solutions scores an A+ in each of these categories. Customers come back to us time and again to help them. We take pride in providing the most personal service we can and solving cleaning problems, big or small.

Anilox sleeves are becoming prevalent in the wider web presses. Does Sonic Solutions have a product to service these?

Walczak: Our Phoenix line of cleaning systems is uniquely designed to work exceptionally with anilox sleeves. We can custom make a system to clean either one or two sleeves at one time. These systems' quality is equivalent to the standards we keep with our smaller systems. But the most impactful part of our sleeves systems is price. Our prices are less than half the cost of wash or laser systems. When wash and laser systems for sleeves can exceed \$100,000 easily that means a lot.

Joe Walczak co-owns Sonic Solutions with his wife, Marie, and they have been helping flexo printers for more than 25 years. They can be reached at Joe_Walczak@SonicSolutionsUSA.com, Marie_Walczak@SonicSolutionsUSA.com or (877) 654-7800.



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The Benefits of Proper Vision Inspection

Print inspection systems are an easy-to-use solution that can be retrofitted to any printing press, enabling operators to setup and run faster, as well as locate and analyze defects before they become critical. Systems include 100 percent print inspection, color monitoring and integrated workflow options.

The importance of vision inspection in a converting application

Often the process is too fast and repetitive to depend on humans to inspect products in converting applications. If inspected during the converting process, waste can be avoided by alerting the operator to process issues. Also, automated inspection enables converters to ship defect-free product to customers and thus avoid contract penalties, product return and rework.

100 percent inspection offers long-term success

Typically, equipment is purchased primarily to satisfy a customer's requirement for 100 percent inspection and the converter realizes the value and uses the ROI generated as a reason for subsequent purchases. Typical return on investment should be within a 24-month period.

Vision inspection systems find the most critical defects

Typically, vision systems see all defects. Most users are not aware of how many defects they generate until they install their first vision system. The key to value is to then decide how to use the data to improve their process and what defects are OK to ship, if any.

Inspection from wide to narrow webs

Vision systems can be used on any web width. Often a single camera is not used on anything wider than 50 inches or so as it would need to be very far from the

web. Inspection systems can be used to inspect threads for currency up to 30-foot paper webs.

Applications that vision systems can be used in

Vision systems can be used for quality control, key feature measurements on processes and also to automate processes that operators find difficult. Vision systems can inspect printed products, coatings, adhesives and converting issues such as seams, perforations and more.

Choosing the right vision inspection system

The first thing is to determine the cost of returns, defects, etc., and then to understand the potential for a return. Once the potential return is determined, it's important to build user requirements and then look at which vendor can meet those requirements. Whether you know where to start, consult an expert today at maxcess.com.

Uniqueness of Maxcess Vision Systems

Our vision systems are built using open system standards improving asset lifecycle and optimizing your investment. Optimized for the process, our systems guarantee that your investment is applied 100 percent. You don't pay for features that are not required. Plus, our systems are reliable and easy to use. Maxcess's advantage is that it supplies a wide variety of solutions and can most likely meet your requirements.

The future of vision inspection technologies

Vision systems will continue to get smarter, in particular with new technologies like deep learning. They will be used to allow operators to improve productivity by dropping operator-to-line ratios.

Vision systems will become more automated and less obvious, as they will be built into the equipment and will become inherent in the operation of that equipment as opposed to being an add-on. ■

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Quality Control Tips for Corona Treating

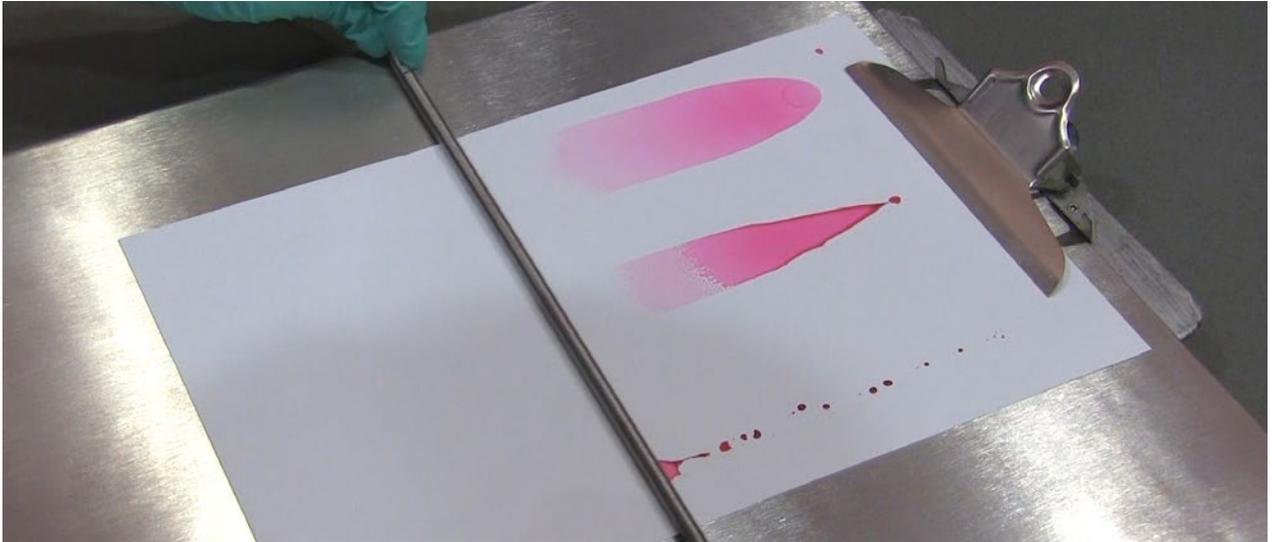
Corona treaters prepare surfaces for printing, coating & laminating by increasing a film's surface energy to enable wetting and adhesion. The most important thing you can do when putting together a quality control program for your corona treating process is to establish successful results and document all material & operational variables and settings. This will arm you with the data you'll need to identify what's changed when you get results you don't expect.

The data you should record includes the type of film you are converting (and supplier), line speed, number of sides treated, applied corona treatment power level, surface energy readings and adhesion results. Below we'll cover some of these areas in more detail.

Films to be treated

Many converters don't realize that different types of films respond differently to the same amount of corona treatment. For example, when PET & PP are exposed to the same amount of treatment, PET is much more responsive. Likewise, receptiveness to treatment can be impacted by different levels of additives in the same type of film. Be sure to record the type of film, the supplier and any additional information you have on additives in your documentation.

[Enercon has an in depth technical paper and webinar on this topic.](#)



Surface Energy Levels Pre & Post Treatment

You should document a film's surface energy before and after treatment. Methods for measuring surface energy include dyne pens, dyne solutions (with cotton swabs or a meyer rod), and electronic diagnostic tools. While this seems rather straight forward, there are a number of mistakes and misconceptions regarding dyne levels.

The primary mistake is not conducting dyne tests in a repeatable and consistent manner. Be sure to train your staff to follow the proper procedures. Also, be aware that testing results from a dyne pen or dyne solution method requires personal interpretation. Two trained people may interpret a dyne result differently resulting in a difference in 1 to 3 dynes. The good news is that for most applications a slight variance in dynes does not affect adhesion.

It's also important to note that surface energy indicates wettability and does not guarantee adhesion. Dyne levels can be used to help predict the chances of adhesion success, but there are numerous material and process variables which can significantly affect adhesion success.

[Enercon has an in depth webinar and technical paper on this topic.](#)

Applied Treatment Levels

Operators understand that increasing the kW output of a corona treating power supply increases the amount of treatment being applied to the film. However, this does not take into consideration changes in the line speed.

At the same power level, a slower line speed imparts more treatment than a higher line speed. It is recommended to measure applied treatment with the Watt Density formula.

The Watt Density Formula combines several operating variables into a single number that provides you with a precise number of applied treatment. The formula takes into consideration line speed, number of sides being treated, width of your active electrode, and the power output from your corona treater.

Watt Density Formula

Power Supply Output (watts)

**Electrode Width (ft) * Line Speed(ft/min) *
Number of Treat Sides**

Enercon's Compak™ Pro power supplies allow converters to run in Watt Density mode; so even when line speeds change, the film will receive the optimal amount of treatment to produce the desired result.

[Try Enercon's online Watt Density Calculator](#)

Your Adhesion Test

The final and most important piece of data to document is the result of your adhesion test. Whether you use a peel adhesion test or other method, this is the standard that should be used to judge your success.

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Increase Profits and Productivity with TAKK Static Control Solutions

Static Control technologies provide tremendous value and benefits toward ensuring optimal productivity and high-quality produced goods. By applying best in class static control technologies converters and packaging printers can prevent production losses, material waste and personnel hazards associated with uncontrolled static electricity, leading to maximizing output and profits.

A well proven strategy for implementing an effective static control program is to utilize the expertise of skilled technical experts in the static control field as well as the processes converters and package printers operate. From this effort, solid evaluation, understanding and problem-solving methods can be employed to ensure resolution of static electricity problems encountered. TAKK Industries' team of technical personnel possess 100+ years of knowledge in industry and static control solutions. What comes from leaning on this expertise is development of comprehensive long-term effective static control within converting and package printing operations.

From extrusion and winding of converted films, to printing and binding of products, it would be difficult to find an application within converting and package printing where static control technologies have not made a tangible difference in improving operations. For over 75 years, TAKK Industries has worked deeply within these industries, becoming well versed in the pain points that processors experience, as well as in developing time true static control solution strategies that we are glad to share with industry.

Our new NEOS Series Static Control Technology with "Reactive Intelligence" is fast becoming the comprehensive, fool proof static control technology that meets the demands of label converters. The NEOS Series is a new evolution in smart static controls providing exceptional capabilities such as using "Reactive Intelligence" that detects and delivers

the exact amount of ionization required - maintaining consistent control of static. Models from the NEOS series eliminate static charges at distances up to 60 inches and speeds up to 4500 ft./min without air.

Additionally, TAKK offers a dynamic range of powerful 24 VDC static control technologies that cover virtually all processes of label printing and converting operations. Incorporating robust built-in power supplies powered by 24 VDC and LED indicators that continuously provide users with local or remote working status of the ionizer bar, these products ensure continuous positive control of static electricity.

TAKK has recently introduced the 3024 Compact and 3024 Ultra DC Static Eliminators. These units are specially designed and suited for both OEM machinery and end-users where there are tight constraints for mounting on digital or conventional label printers, tabletop winders, and related production machinery requiring high performance static elimination performance in a compact size. The 3024 has a built-in power supply and LED indicators that provide local and remote status for the ionizer bar. The 3024 Ultra and Compact are highly suited for narrow labels, webs, sleeves, and tapes.

With a full line of static control solutions, TAKK is prepared to solve any static control issue that interferes with production and profit. ■



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CORONA TREATMENT

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QC Electronics, Inc. is a family owned and operated company located in Portage, Wisconsin. We design and manufacture a complete line of corona treatment equipment. Corona treatment is a science-proven process used to increase the surface energy of materials thus increasing the material's adhesion capabilities.

Throughout 34 years of business, QC Electronics, Inc. has remained the leader in reliability. Our equipment's design is based on the study of the adhesion capabilities and characteristics of various materials on a molecular level. To find out more about how corona treatment can benefit your material and why QC is the most profitable option, contact sales@qcelectronics.com.



The Relationship of Surface Characteristics and Successful Corona Treatment

By Alyxandria Klein, Contributing Writer

The way a material responds to treatment is directly related to the material's molecular structure. Every material's structure is different and should be treated so when deciding on a watt density level (power level and exposure time to corona discharge).

The crystallinity of polymers effects the rate that their surface energies increase. As the crystallinity of the polymer increases (from lower to higher, PE, PEP, PP), longer exposure time is needed to increase the surface energy.

Corona Treatment Definition

Corona treatment is a scientifically proven surface modification process that has been practiced in various forms for over 70 years. The object of surface treatment as a corona process is to render a typical plastic film or surface receptive to inks, glues and coatings. The process is most widely known for its ability to improve the surface bonding characteristics of various materials.

Understanding Surface Energy

Corona treatment introduces polar functional groups such as hydroxyl, carbonyl and carboxylic groups onto the film surfaces. The presence of these functional groups on the film surface raises the film surface-free energy. Understanding a material's surface energy is vital to a successful process, especially when coating, laminating or printing. The surface energy (or surface tension) of a liquid is the amount

of excess energy at the surface of the liquid. Surface tension exists because molecules in the bulk liquid are in a lower energy state at the surface. When a liquid droplet is placed on a solid surface, what happens depends on the relative surface energy of the liquid compared to the surface energy of the solid. If the liquid has a higher surface energy than the attractive forces between the liquid and the solid surface, the liquid droplet will prefer to maintain its spherical form. This type of droplet is called a hydrophobe. On the other hand, when the surface energy of the liquid is lower than the surface of the solid, the liquid will wet out on the solid surface. This phenomenon is referred to as a hydrophile. See Figure 1. For an adhesive to wet a solid surface, the adhesive should have a lower surface tension than the critical surface tension of the solid. This is the reason for surface treatment of plastics, which increases their surface energy and polarity.

Determining Target Surface Energies

The target surface energy of a material depends on the process and coating. Printing processes will require different surface energies than laminating or coating processes. The type of printing process (Flexo and Gravure, Litho, Offset/Letterpress, Screen and Pad) should be considered, as well as coating type (water, solvent or UV). Waterborne adhesives universally require higher surface energy levels than solvent-based systems. Table 1 provides some recommended values based on process and coating type used.

Means of Measurement Dyne Testing

Dyne testing is common for estimating the treatment level of plastic surfaces in production environments. It involves using solutions made from a mixture of two chemicals that produce liquids (dyne) with surface tensions in the typical range of 30-70 dynes/cm. The test consists of applying various dyne liquids to the treated surface and observing the spreading of the drops over two seconds. This method allows for quick and easy estimates of treatment levels, which makes it useful and popular in

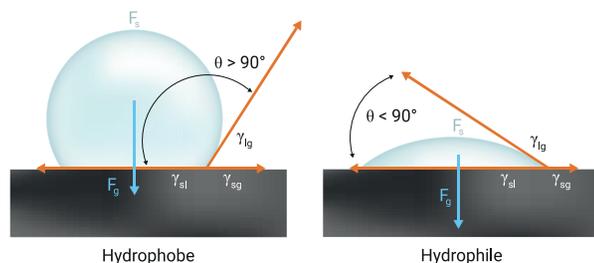


Figure 1: Hydrophobe vs. Hydrophile

| Substrate | Coat- ing Type | PROCESS | | | PRINTING PROCESSES | | | | | | | | OTHER PROCESSES | | | | | | |
|-----------|----------------------|-------------------|--------------|----|--------------------|--------------|----|---------------------|--------------|----|----------------|--------------|-----------------|-------|--------------|---------|-------|--------------|----|
| | | Flexo and Gravure | | | Litho | | | Offset, Letterpress | | | Screen and Pad | | Laminating | | | Coating | | | |
| | | Water | Sol- vent | UV | Water | Sol- vent | UV | Water | Sol- vent | UV | Water | Sol- vent | UV | Water | Sol- vent | UV | Water | Sol- vent | UV |
| SPE | | 38 | 36 | 38 | 40 | 37 | 40 | 40 | 37 | 42 | 42 | 38 | 44 | 42 | 38 | 42 | 42 | 38 | 44 |
| | | 44 | 40 | 50 | 46 | 42 | 50 | 46 | 42 | 54 | 48 | 44 | 60 | 50 | 44 | 54 | 48 | 45 | 54 |
| PP | | 38 | 36 | 40 | 40 | 38 | 40 | 40 | 37 | 40 | 42 | 38 | 44 | 42 | 38 | 42 | 42 | 38 | 44 |
| | | 44 | 40 | 50 | 46 | 42 | 50 | 46 | 42 | 54 | 48 | 44 | 60 | 50 | 44 | 54 | 48 | 45 | 54 |
| PVC | | 38 | 36 | 36 | 40 | 37 | 36 | 40 | 38 | 40 | 42 | 38 | 42 | 42 | 38 | 42 | 40 | 38 | 42 |
| | | 44 | 40 | 50 | 45 | 42 | 52 | 45 | 42 | 52 | 48 | 44 | 60 | 50 | 44 | 54 | 48 | 45 | 54 |
| PET | | 44 | 40 | 42 | 46 | 42 | 44 | 46 | 42 | 46 | 48 | 42 | 44 | 46 | 42 | 44 | 42 | 42 | 46 |
| | | 52 | 46 | 54 | 56 | 46 | 56 | 46 | 60 | 60 | 48 | 62 | 60 | 48 | 62 | 52 | 48 | 60 | |
| PS | | 38 | 35 | 42 | 40 | 37 | 42 | 40 | 38 | 42 | 42 | 38 | 42 | 42 | 37 | 42 | 42 | 38 | 44 |
| | | 44 | 40 | 48 | 45 | 42 | 50 | 46 | 44 | 58 | 48 | 44 | 56 | 52 | 44 | 54 | 50 | 46 | 54 |
| PU | | 40 | 38 | 38 | 40 | 38 | 38 | 40 | 38 | 42 | 42 | 38 | 42 | 42 | 38 | 42 | 42 | 38 | 44 |
| | | 46 | 42 | 50 | 46 | 42 | 52 | 45 | 44 | 56 | 50 | 44 | 58 | 50 | 44 | 56 | 48 | 46 | 54 |

Table 1: Target Surface Energy

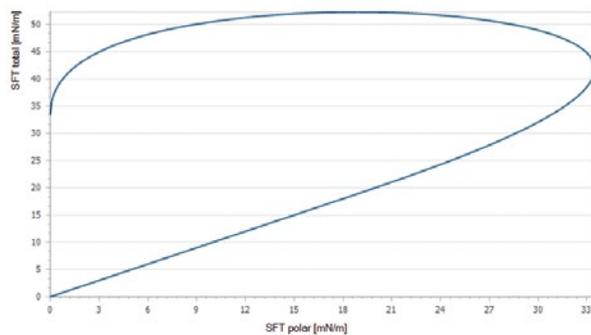


Figure 2: Wetting Envelope

production environments. A more quantitative approach is the measurement of contact angle, which decreases with an increase in treatment level. A perfect wetting liquid forms a contact angle of zero on the solid surface.

Contact Angle Measurement

Wettability may also be determined by measuring the contact angle between the surface and the drop of a liquid such as distilled water. A small contact angle indicates that the liquid is wetting the polymer effectively, while large contact angles show that the wetting is poor (see Figure 2). This company utilizes a surface analyzer to measure surfaces and collect data on all samples. The surface analyzer places a droplet of water onto the surface along with a droplet of diiodomethane (polar element required to calculate precise surface free energy). The analyzer measures and records the contact angle of the droplets using a microscope and calculates the surface free energy. A wettability report is then generated including a wetting envelope (see Figure 2).

Maintaining Material Integrity

Corona treatment is not a mechanical bonding process. A corona treater should be designed to allow the least physical roughening to the material as possible. A simple way to tell if the corona treater has maintained integrity in an R&D setting is to run your hand along the treated area of the film. If you can physically feel the film is rougher in the area that was corona treated, this is a sign of unnecessary roughening. The corona treater changes the molecular properties to increase surface energy to a compatible level of the application. When performed correctly the process does not alter the physical appearance or texture.

Corona treatment is a great process for improving the bonding characteristics of materials when the science and physics of corona treatment are followed correctly. This process allows companies to expand their horizons and offer a more profitable, high-quality product. There are many variables that go into deciding a target treatment level (surface energy), and all should be considered to get the most out of corona treatment and its surface modification capabilities. ■

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Alyxandria Klein is the Marketing and Sales Director, QC Electronics, Inc. To assist in her role, Klein utilizes sophisticated surface analyzation equipment to study the molecular structure of materials pre and post corona treatment. She can be reached at sales@qcelectronics.com.

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Achieving Quality and Controlling Costs for Silicone Release Coaters

Controlling quality and costs are critical challenges in the coating and converting processes. That is why coating or composition analysis is essential for silicone release coaters. Product quality depends on

proper coating thickness or coat weight. If coatings are not in spec, this can lead to product failure. If too little or too much silicone is applied, this can change the product's characteristics resulting in product rejection and reduced profitability. Achieving a targeted laydown to ensure release properties or barriers are not compromised is crucial.

Rigaku EDXRF (energy dispersive X-ray fluorescence) technology provides non-destructive coating or composition analysis for web applications. It is a standard technique used by the paper and film industry for determining silicone coating thickness and composition. Applied Rigaku Technologies offers at-line or in-line analysis solutions.

For in-line process control, the **NEX LS** linear scanner offers cross and machine direction Si coat weight profiling of your process. To maintain consistent quality, improve efficiency, and minimize cost, the

NEX LS allows continuous monitoring without the need to stop production. It offers technicians valuable information to quickly identify problems related to the quality of the entire roll as it's being produced.

NEX LS software is easy to use and provides a clear visual representation of the process, helping technicians make immediate quality control decisions. Using a flow bar method builder, users input basic information about their application, and the advanced **NEX LS** software helps achieve continuous process control from the beginning to the end of the roll.

Its analytical head sweeps back and forth across a moving web, and the scanner transmits measurements to a console box and industrial touchscreen computer where real-time data displays as a graphical cross direction and machine direction profile. The software includes user-defined recipes, including scan speeds and sub-second measurement settings, and advanced roll reporting provides quality records or audit trails.

Roll reports include machine direction, cross direction, and full lane average graphs — measurement



value, date, time, length, product name, and other information. Users can customize reports and export as PDF or CSV and store copies to USB or a network using industry-standard communications protocols.

NEX LS gives users the ability to monitor their process — real-time — from start to finish.

For rapid at-line solutions, the **NEX QC** Series benchtop EDXRF analyzers enable the measurement of very low silicone coating weights and metal catalysts in silicone coatings, all with one instrument. Challenging applications that were marginal or not possible with earlier technologies are now a reality.

NEX QC Series spectrometers do not require helium or a special sample cup for Si determination.

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LinearPlasma – Improves surface energy on materials of any thickness, modern high-tech films, printed electronics, foam and panels.

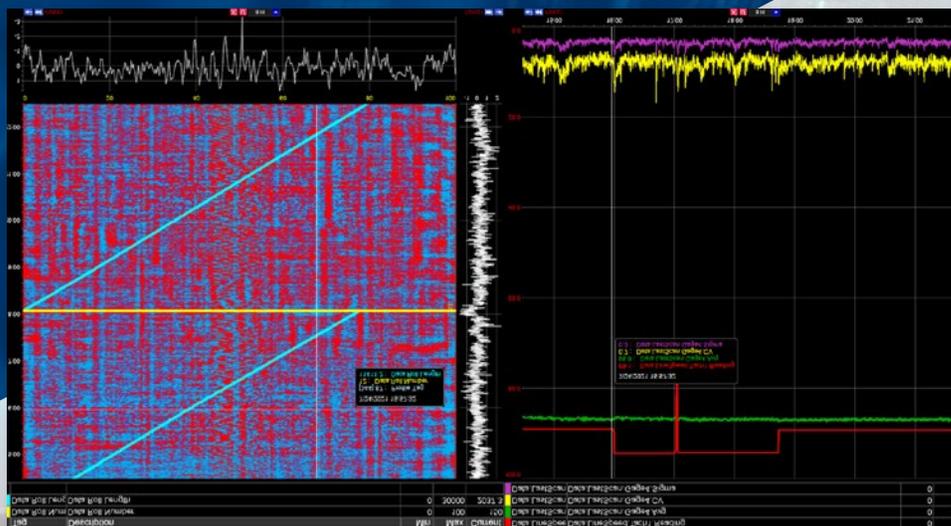
SORBAL Ozone Destruction System - The exhaust from corona treaters is channeled into this high-performance filter system.

38 Dyne Test Pens – SOFTAL produces the best, reliable and economical dyne pen for testing the surface tension of materials.

SOFTAL is represented in North America by 3DT LLC of Germantown, Wisconsin; providing U.S. sales, service and support. This strategic partnership provides solutions for coatless adhesion challenges for numerous industries. 3DT manufactures a broad line of surface treatment systems, all customizable for unique applications. For more information contact sales@3DTLLC.com or visit our website at www.3DTLLC.com.



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NDC Technologies' Legacy of Delivering Solutions Continues

By Jay Luis, Global Marketing Communication Manager at NDC Technologies

If you've been following NDC Technologies in the press or social media, you know that we've been at delivering innovation for a long time. Over a half a century!

What makes us unique is that we offer the broadest range of measurement technologies in the industry – including laser, X-ray, infrared, optical, beta/gamma ray, ultrasonic and terahertz, to name a few. Our gauging systems are in service in more than 100,000 customer applications around the globe. From moisture to thickness ... to coat weight and density ... to diameter and length and speed measurements, were involved in a diverse array of applications, solving the most unique measurement challenges. Our investment in application-specific solutions has enabled manufacturers to improve the quality of their products, increase productivity, boost process efficiencies and realize significant production savings.

Well, our legacy of delivering solutions to industry continues with the release of some new products this year. Let me give you a brief product introduction.

New Series 9 Converting Gauge

We released the new Series 9 on-line gauge for food, bulk industrial material and tobacco processing applications in 2020. And this innovation solution is seeing great interest from numerous manufacturers in these industries. This platform was so successful we took this gauging system one step further and developed a powerful measurement solution specifically for the converting industry — the [Series 9 Converting gauge](#).

Here's what our product manager for our film extrusion and converting business, Mark Rainville, said about the new product: "The Series 9 Converting gauge is the sum of what we've learned over the past years to meet the manufacturing challenges faced by the converting industry. We're excited to deliver the best-in-class, best-in-value measurement system on the market today. This product is equipped with a unique set of capabilities for unparalleled measurement performance across a wide range of converting applications."

The new Series 9 Converting gauge offers so



many exceptional features and benefits such as "greater process vision." When integrated with NDC's high-performance single-beam scanners, such as the new SlimTrak II (which I'll talk about a bit later), and the Pro.Net TDi web gauging controller, it provides process vision far beyond that of conventional in-process measurement systems. Users can effectively perform ultra-accurate measurements of moisture, coat weight, degree of cure and film/layer thickness across a wide range of converting applications such as extrusion, coating and lamination.

And there's "long-term stability." The Series 9 Converting gauge delivers ultra-reliable operation with no need for recalibration, systematic monitoring or correction for drift. Let's not forget "advanced diagnostics." This gauge is also equipped with a powerful feature set for preventative maintenance to ensure maximum uptime. Last but not least, "low cost of ownership." The Series 9 Converting gauge is easy operate and maintain, enabling manufacturers to realize immediate and long-term value over the lifetime of operation.



New DataFusion Data Visualizer and Historian

[DataFusion](#) is our latest software innovation for real-time visualization of quality measurements. This powerful software platform lets you harness measurement data from film extrusion, coating and lamination lines and transform it into actionable intelligence. DataFusion collects quality measurements of thickness, weight, moisture and coat weight from these lines and pipes it to an SQL database. Measurements can be either fixed point or scanning.

DataFusion creates a visual representation of this data so you can quickly view product quality in real-time and historically. This next-level insight enables manufacturers to accelerate the data-to-decision process, improve product quality and realize production efficiencies. DataFusion is easy to use and offers complete flexibility due to its modular nature, and

provides an intuitive interface and multiple easily scalable visualizations.

Latest SlimTrak II Narrow Web Scanner

We released the new [SlimTrak II](#) scanner last year, but I wanted to take a moment to describe it again. As I mentioned above, it can be integrated with the new Series 9 Converting gauge.

SlimTrak II is the next-generation, single-beam scanner that is uniquely designed to fit into the tightest machine spaces. This is a huge advantage not found with other scanning systems on the marketplace today. The extremely compact footprint requires minimal installation space, allowing you to capture critical measurements. The SlimTrak II scanner also offers applications versatility and can be used on production lines across a wide range of processes including lacquer coating on foil, adhesive tapes, label stock, hotmelt coaters, dry lamination, re-moisturizing, water-based coatings, extrusion coating and laminating, and sheet extrusion, to name a few.

Some Closing Thoughts on Innovation

Research and development form a vital part of our business. We continually work to advance our product line, creating new solutions to face the challenges of the ever-changing marketplace, as well as improving existing products to enhance ease of use, measurement precision and next-generation connectivity. If you're facing a unique measurement challenge with your application, we can help you.

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The IQ Power system combines exceptional ionization performance and ultimate monitoring intelligence with user-friendly functionality. This fully integrated scalable system makes installation a snap. There is no complicated software to install and the "smart addressing" technology and flexible mounting options make this system and its components easy to add to any existing application. Configurable parameters allow the user to understand, monitor and control their static neutralization challenges. The core of the IQ Power System is the Control Station, which includes a full color touchscreen designed with an intuitive interface and user-friendly features that help users monitor up to 10 neutralizing devices and control the system globally or by device.

By incorporating the IQ Power Wireless Link, gone are the days of long costly cable runs. The IQ Power Wireless Link is designed to be a cable replacement kit that wirelessly allows devices to communicate and provides much easier and cleaner installations. With the elimination of cables, the Wireless Link also allows for static control monitoring in places where mounting was previously unavailable. This communication is all done via Industrial Bluetooth, working independently of and not appearing on WiFi networks.

The need for quality static control and monitoring the static environment has become more and more critical. As the converting industry continues to require cleaner and higher-quality output, a smarter static neutralization system is key to success. As the worldwide leader in static control, Simco-Ion's application experts offer individualized static solutions to meet the needs of today's converting industry.

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Combating the Invisibles of Static Control

Contributed by Kevin Coldren, Simco-Ion Sales and Business Development Manager

Ions are all around us, and, when trapped on an insulative surface or isolated conductor they create static charges which interfere with value added converting processes like printing, coating, slitting, and laminating. This interference can take many forms: printing/coating defects, process slowdowns/jams, contamination and operator shocks, to name a few. Unless remedied, this interference will continue unabated, as will the losses to the converter.

How does one combat the invisible? Start with introducing smart technologies: monitored static eliminators, supported by static sensors, and closed loop feedback systems. Take a systematic approach that proactively eliminates static and provides communication and then add in connectivity to your PLC, so that data on system performance is available when and where it is needed.

Once the interference posed by static charges is eliminated, converters may still have to deal with residual contamination. Rather than relying on compressed air devices that simply relocate the contaminates, best practice is to employ a means of capturing the contaminate such



The IQ Power Static Neutralizing System is an unparalleled lineup engineered with the technology that brings complete monitoring intelligence with a user-friendly interface. The system provides the highest performance available with versatile, innovative configuration and simple installation options.

that it is not only removed from the substrate but eliminated from the converting process. Current generation contact cleaners rely on engineered, traceable elastomers and adhesives, evolved well beyond the “tacky rolls” of old, and remain the best choice for printers, coaters and metallizers who insist on eliminating contaminate from their critical, valued added processes. For faster web speeds, or applications where voluminous contaminate threatens to overwhelm the converting process, there are vacuum systems, some

with newer clamshell designs, that will consistently remove particles well below the visible (>50 micron) spectrum. These vacuum systems incorporate monitored static control and monitored vacuum levels for maximum effectiveness.

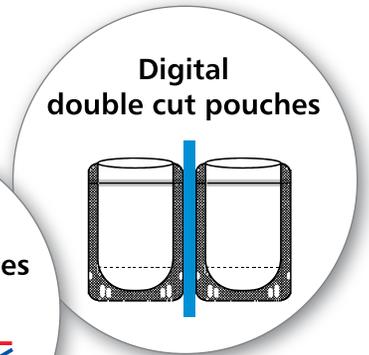
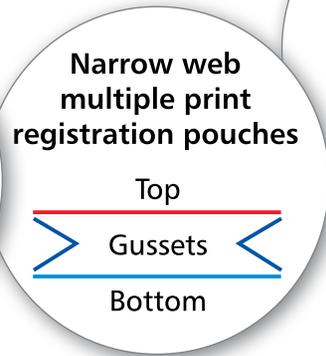
While ions, static charges, and associated field lines remain largely invisible, their negative impact to converters is not. Higher web speeds increase the charge on a substrate which then traps contaminate and leads to printing and packaging defects. Field lines coming from the charged surface interfere with printheads, nearby electronics and are directly linked to operator shocks and fire risks in hazardous environments. Even after static removal a 10-micron particle held onto the web by gravity will become a clearly visible 100-micron particle after coating or lamination, resulting in an obvious defect. A systemic, ROI driven approach to static and web cleaning, that takes clear advantage of advances in automation (high power, small space ionizers, Industry 4.0 communication) and cleaning technology, is the best way for the converter to improve safety, lower operating costs and improve efficiency. ■

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Mamata's converting Machinery range includes high-speed Wicketers, high-speed flatbed poly bag machines and versatile pouch machines.

Mamata Wicketers are high-speed and easy to operate. We have designed it for optimal output and price combination. With speed up to 425 cycles / minute, we offer widths 600 mm (24"), 800 mm (32") and 1000 mm (40"). You can make conventional bread bags to diaper / hygiene bags, E-Commerce bags, String zipper bags, Produce Bags, etc. For string zipper applications, we offer fastest production rates of upto 250 bags / minute.

Our Flat Bed Polybag Machines are available in widths of 600 mm / 750 mm / 1000 mm / 1200 mm / 1400 mm. With speeds of upto 400 CPM, we offer Solid Roll configuration and Split Roll configurations. Fastest changeovers (under 10 minutes) from Side seal to Bottom seal to twin seal on our Universal Machines sets us apart from our competition. We offer complete solutions for applications like E-commerce mailer bags, diaper / hygiene bags, heavy-duty



fertilizer / salt / potting mix bags, string & flange zippered bags on these machines.

Our pouch Machines are available in widths of 410 mm / 610 mm / 820 mm and 1020 mm. With speeds of upto 250 CPM, these are the most versatile Pouch machines available in the industry today.

Our Ability to run recyclable Mono-material recyclable structures makes us unique.

Our Pouch machines can be configured to make simple 3 side seal Pouch to the complex flat bottom pouch from multiple webs with Print registration control. With patents in USA, Europe & Japan for flat bottom pouches, we are the only company that offers machines to produce flat bottom pouches with terminated gussets & zippers in 2 lanes.

We also offer machines for flower/candy sleeves, non-woven fabric bags, laminated woven sack making, etc.

For end users and brand owners, our Horizontal Form Fill & Seal Roll stock Machines are available with speeds up to 120 Pouches / Minute filling speeds and covers pouch sizes from 80 – 300 mm.

Our Premade Pouch filling systems can handle pouch sizes

from 125-300 mm width. This range takes care of nearly 99% of the Single serve pouches to club size pouches. This machine is designed to handle regular 3 side seal Pouches, stand-up Pouches with or without zippers as well as Flat Bottom Pouches with terminated gussets and zippers with same ease.

Both our rollstock and pre-made pouch fillers are the fastest simplex machines available in the industry using conventional servo technology. Our rollstock machines runs 120 ppm mechanical speeds and our premade pouch fillers can fill pouches at up to 65 ppm in simplex format.

With quickest changeovers in the industry, these machines are set to change to course of the packaging industry. ■



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