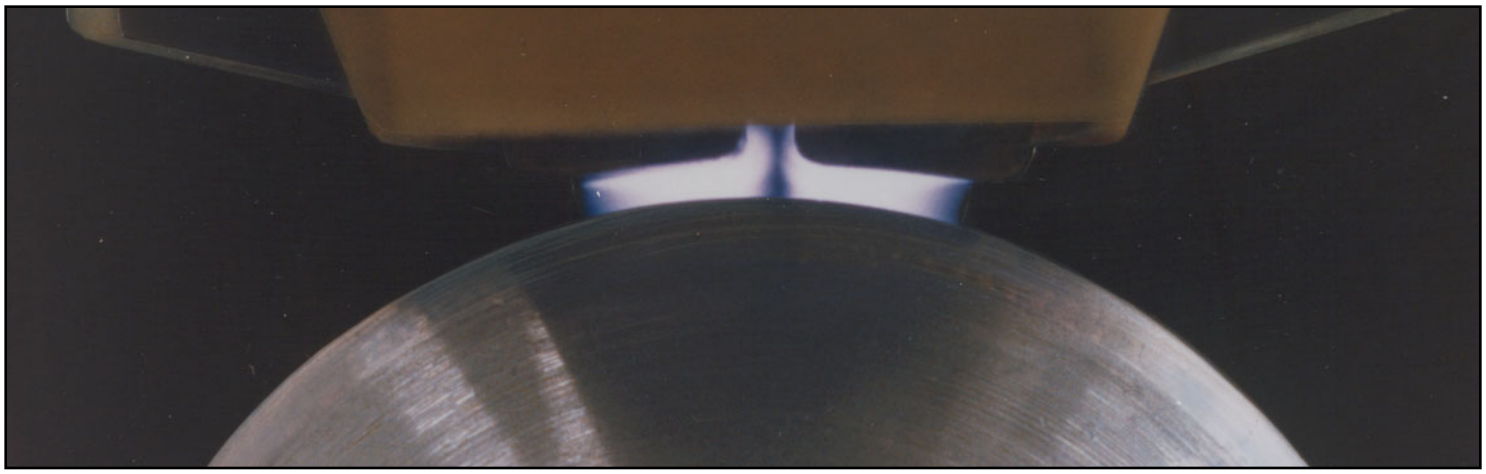
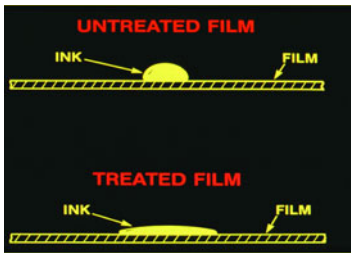
Corona treating and the solvent printing process



There are a number of external pressures on the converting industry which are increasing the need for surface treatment of substrates before printing. Printing on polyfilm or metallized films and foils instead of paper presents many production challenges. In addition, competitive pressures are pushing converters to produce a higher quality product at ever increasing line speeds. These factors contribute to the increasing use of the corona treating process before printing.



Surface treatment promotes ink adhesion.

The key factor in this equation is the difference in surface energy between the fluid vs. the substrate. If the surface energy of the ink is higher than that of the substrate, it will not "wet out" and the resulting adhesion and print quality will be poor. Solvent-based inks have a relatively low surface energy and in many cases are used on a variety of pretreated substrates.

For Steve Utschig of Fox Valley Technical College, the decision is a simple one. "For the price and quality assurance corona treaters provide they're a great value. Besides it only takes one or two rejected jobs or quality issues to justify the cost of a treater."

"Whether I had a water or solvent based press operation I'd have a corona treater on it."
- Steve Utschig
Fox Valley Technical College

Corona treating on a solvent line? Welcome to conventional thinking overturned

Conventional thinking indicates that pretreated material does not require additional in-line treatment when using solvent based printing. However many printers are learning that there are several advantages to be gained from adding in-line surface treatment to their process. These printers tend to be industry leaders that are proactive in taking control of their printing processes.

The image above was printed on a substrate that only received surface treatment on the top.

These printers benefit from in-line surface treating through better ink adhesion and wetting, elimination of pinholing in solid colors and gradients, and overall improved print quality. Materials with higher surface energy may require a secondary (or "bump") corona treatment of the substrate to ensure proper adhesion.

Consider the experience of Steve Utschig. He's one of the top Flexographic Printing Instructors around and his expertise is the result of over 22 years in the converting industry. Steve says, "Whether you're using water or solvent based printing you want to ensure the surface energy

Universal-roll treaters ensure optimal dyne levels.

of the substrate is as consistent as possible. The best way to guarantee ink adhesion consistency is with a corona treater."

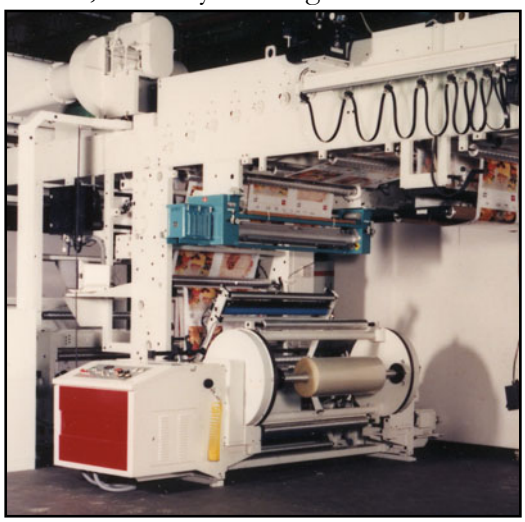
Real World Experience

The team at Tufco in Green Bay, Wisconsin has first hand experience with treating for both solvent and water based printing. Quality and productivity are important to them. The impressions they make on Fortune 500 companies are backed by an ISO 9000 1:2000 certification. Base Operations Manager Bruce Pagel says the company had run older lines without corona treaters and has seen dramatic results.

"There's no doubt that our lines with corona treaters have less delays and downtime. The treaters provide a safety net that assures surface dyne levels are optimal for printing."

- Bruce Pagel
Tufco, Base Operations Manager

Not all printers are as progressive as Tufco. Steve Utschig uses his flexographic training seminars to try and teach more conventionally thinking printers that surface treating can make a big difference. He says, "If there are printers who reject the idea of surface treating, they should possibly reconsider their thinking. Films are pretreated, but they're not guaranteed to be perfect when it comes time to print. Treatment degrades over time so that's one issue you have to contend with. And, even if the film makes the grade on a dyne test you still have the possibility of additives rising to the surface. These surface imperfections can result in pinholing and other quality issues. A corona treater can help to eliminate these problems."



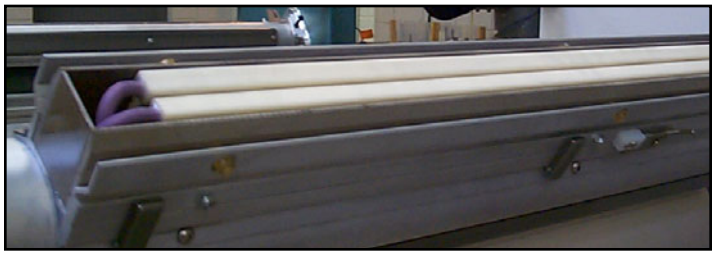
Surface treaters can be designed to mount virtually anywhere on a printing press.

Tufco's Pagel supports the assertion that not all pretreated film is created equal. "Variances in dyne levels of pretreated material can be considerable. If your film supplier is overseas or if you've had the material in storage there can be a significant decay in pretreatment levels over time."

Progressive printers and educators aren't the only ones who recognize the benefit's of in-line treating. Tufco's Bobbi Marchand says her customers are getting smarter about corona treating and the printing process as well. The Sales Manager for Flexographic Printing says, "Many of my customers will ask if we bump treat in-line. They're aware of the improved adhesion that results from consistent dyne levels. And it also helps minimize the chance for roll blocking." Marchand adds that it makes her sales job easier having corona treaters on Tufco's presses. From films to non-wovens she knows Tufco can handle many jobs successfully that other printers can't. As Tufco knows, sizing a corona treater is as important as selecting the right one.

Properly sizing a corona treater station

There are six major factors to determine a suitable size and type of corona treater for a given application.



Ceramic tube electrodes offer great flexibility and are an ideal choice for solvent printing.

1) Basic Material Type
2) Additive Load
3) Web Width
4) Line Speed
5) Number of sides to be treated
6) Dyne level required

From this information, the watt density (w/ft²/min) requirement can be calculated. This determines the output power required, as well as the type of treater station. These calculations can vary from manufacturer to manufacturer and are based upon their own application experi-

Today's power supplies are efficient and compact.

ence. You can, therefore, have two very different recommendations for the same application from different corona treater manufacturers. Be sure that the manufacturer will guarantee to meet your written application requirements.

The power supply

The corona treating power supply generates high voltage, high frequency electrical energy which is then passed through an electrode assembly into an air gap which creates an ionized field, or corona.

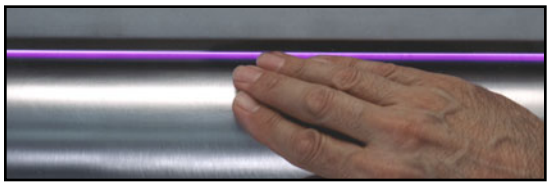
As the film passes through the corona, its surface becomes oxidized and the surface energy raised. This makes the substrate more receptive to bonding with inks, coatings or laminations.

The power supply accepts standard 50/60Hz utility electrical power and converts it into single phase, higher frequency (nominally 10-30 kHz) power that is passed through a high voltage transformer to the treater station. Today's sophisticated power supplies will utilize IGBT technology, although SCR and even tube-based units can still be found in the field.

One important feature mentioned by corona treater manufacturers is the "turn down" ratio, which is the power supply's ability to run at very low power levels and still deliver an even corona across the face of the electrode. This feature could be useful when treating a wide range of substrates. An additional feature is "load matching" which is the ability of a given power supply to automatically adjust itself to the load. This is important should you be planning to replace an old power supply on your existing treater station.

The treating station

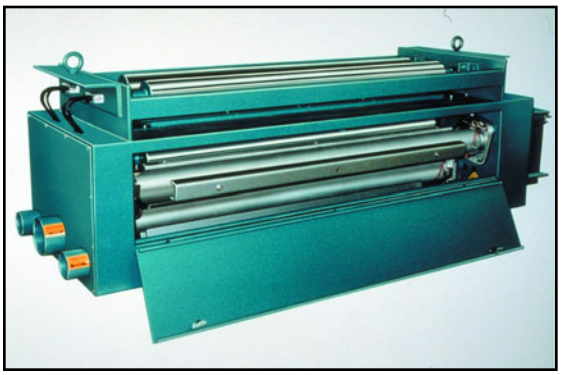
The treating station then applies the electrical energy generated by the power supply as corona through an air gap to the substrate. The two most important components of the station are the electrodes and ground roll. Looking first at the electrodes, the most common type for solvent based printing applications are ceramic tube electrodes.



Bare-roll systems eliminate the need for roll coverings and reduce the chance of electric shock.

Ceramic electrodes offer greater flexibility than metal electrode systems as they can treat any material, including metalized films and foils. They are primarily used in printing, coating, and laminating applications. One of two different ground roll systems can be used with ceramic electrodes; either the bare roll or the universal roll system.

The bare roll system uses a bare aluminum ground roll which eliminates the need to replace roll coverings. This system is also safer than covered roll systems because it reduces the possibility of electrical shock while working in close proximity to the station. An additional benefit is that it allows for an open construction of the treater station for easier maintenance access and thread up for systems located outside of the areas with solvents.



"Pressurized" treaters are designed to work safely in solvent production areas.

"The treater is really an invisible component on the line."

- Bruce Pagel
Tufco, Base Operations Manager

Safe corona operation for solvent areas

Enercon also manufactures a closed station rated for Class I, Division II, Group D locations. While not explosion proof, the "pressurized system" features positive pressure air-flow for safe operation in solvent areas. Doors on the system allow operators to access system components when the line is not in operation.

The universal system is similar to the bare roll but features a ceramic coating on the roll. It provides safety for both open and purged station designs. It enhances treatment levels on a variety of substrates, eliminates the possibility of backside treatment, and will last for very long periods of time if used properly.

If you've never operated a corona treater before have no fear. They are simple to operate and maintain.

Factors influencing the corona treatment process

Different substrates have different initial surface tensions. This can range from 29-31 for PP to 41-44 for PET. Surface energy is generally measured in dynes/cm2. It can be measured by using dyne solutions, although other methodology is common in the industry. Dyne pens can be more convenient to use on the shop floor than the solutions, but their tips can be easily contaminated and give faulty readings.

Contact angle equipment is also available, but it is expensive and, unless properly used, will not necessarily be more accurate than the solutions. It is worth noting that dyne solutions are a hazardous material and must be handled and disposed of with care. Most films are corona treated at the point of extrusion, but the treatment tends to decay with time.

The decay can also be influenced by a number of factors including additives, ambient temperature during storage, and the effects of rewinding, among others. It is, therefore, quite common for secondary treatment to take place just before printing to "bump" the substrates back to their original surface energy levels. If the material has not been pretreated, however, it becomes virtually impossible to alter by post-treatment.

The size of the corona treating power supply and type of station is influenced by other factors such as line speed, additive load, etc. The faster the line speed, the larger the power supply required as the contact time of the substrate within the corona is reduced. Conversely, many converters have found they can treat difficult substrates by slowing their line speeds when necessary.

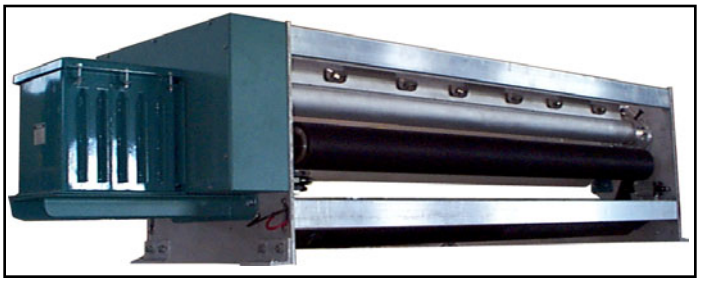
The corona treating process creates ozone as a by-product. Ozone is a health hazard and will also corrode the equipment if not properly exhausted from the work area. There are strict environmental regulations in some areas which will require the use of an ozone decomposer, which is available from most corona treater manufacturers.

New technology

New developments in atmospheric plasma surface treating are opening doors to new applications. Enercon's recently introduced Plasma3™, a significant development in surface treating technology. Plasma offers 4 key benefits.

1. Longer life treatments

Substrates that have been plasma treated hold their treatment levels far longer than corona treated surfaces. Longer treatment life allows converters to take advantage of economies of scale during production, increase inventory life and gain manufacturing flexibility.



When the corona process is ineffective, Plasma is an excellent alternative.

2. Higher treat levels allow for treatment of difficult to treat surfaces.

Plasma treatment is a viable alternative for a variety of substrates which corona treating is ineffective. For example fluoropolymer-based materials, like Teflon®, do not respond to the corona process, but do respond to plasma treatment.

3. Treatment of thicker substrates

While substrates that are thicker than .125" usually do not respond well to the corona process, they can be treated by Plasma3™. Films, foams, non-wovens as well as fibers, metals and powders are all candidates for plasma surface treatment.

4. Add Value

Plasma adds value to film and packaging by etching and fuctionalizing surfaces.

Summary

• Corona treatment is now widely used in the converting industry to improve the adhesion of solvent-based, water-based and UV cured inks to polyolefin & metallic substrates.

• The electrical corona is created by a power supply which passes the high voltage energy through a treater station into an air gap. The air becomes ionized and will oxidize the film's surface, thus raising its surface energy.

• Corona treaters are available with either metal or ceramic electrodes and with several ground roll designs. Stations are also available for operation in Class 1, Division 2, Group D environments.

• The design of the corona treater is based upon six key application parameters.

• Differing substrates have different initial surface energies and will respond to the treatment process in different ways. It is important to always use pretreated materials.

• Corona treatment creates ozone as a by-product which must be exhausted from the work area.

• Atmospheric plasma offers the possibility of longer life treatments, higher treat levels, treatment of difficult to treat surfaces and thicker substrates.