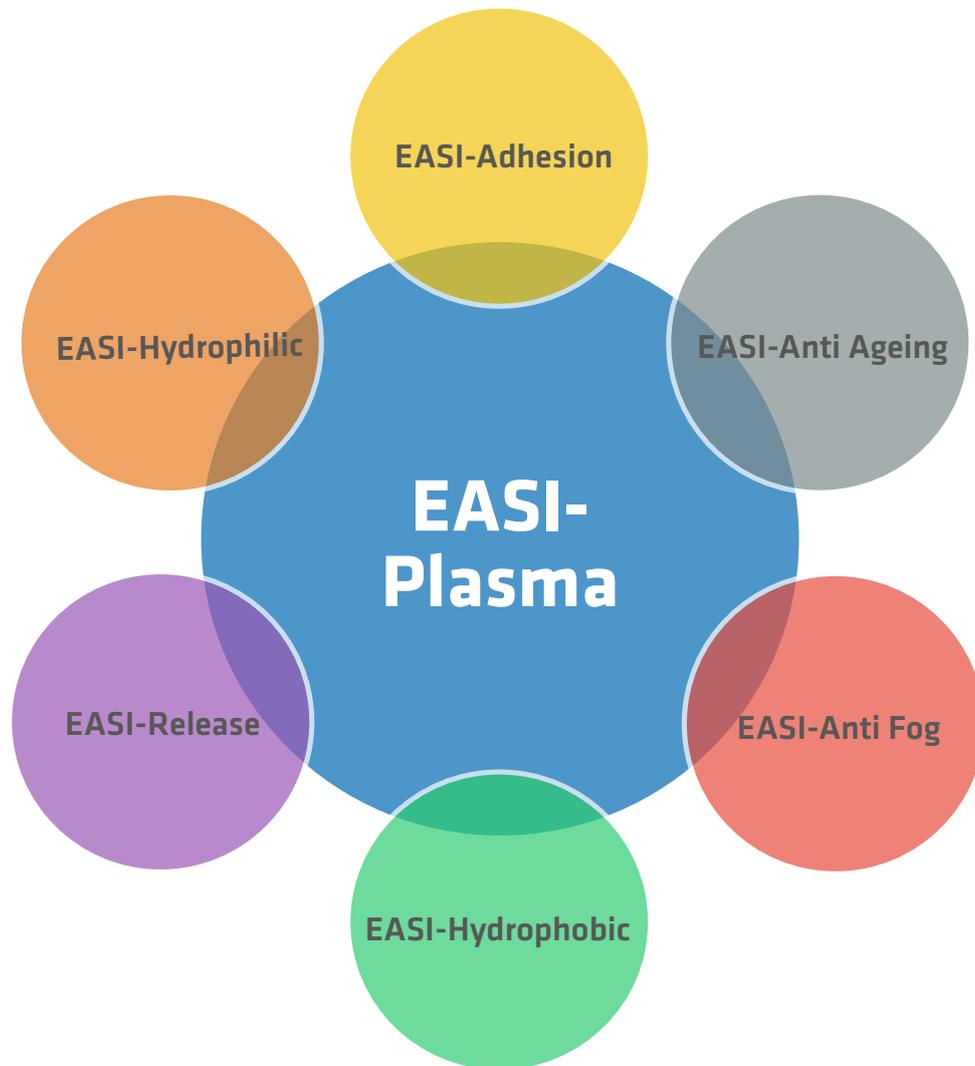


# EASI-Plasma



EASI-Plasma

# APPLICATIONS



Corona treatment is currently the most used technique in the industry for treating surfaces of polymer films and other substrates. Corona is a Dielectric Barrier Discharge (DBD) in air, the electric discharge is controlled by a dielectric barrier and is in the form of streamers distributed over the surface. The objective of the polymer treatment is to increase the surface energy and subsequently the wettability and adhesion for laminating, printing and other converting processes.

However there is a more advanced technology available; Enhanced Atmospheric Surface Improvement (EASI-Plasma) in a DBD Plasma. Created by a controlled atmosphere, adding small quantities of dopant gas for grafting and dopant monomers for nano coating, it allows different functionalisation and a whole range of surface abilities.

EASI-Plasma is more homogeneous and “softer” than Corona, with low heat impact to the surface enabling the realisation of versatile controlled and tuneable surface chemistry. Consequently, it can be considered as a gas primer that efficiently replaces both the use of corona treatment and liquid primer.

Vetaphone and Coating Plasma Industrie have established a technical and commercial partnership combining their respective expertise to offer state of the art plasma technology at atmospheric pressure for the benefit of customers. The direct benefits of this “all-in-one” eco-efficient plasma process are reduction of costs, energy consumption and impact on the environment.

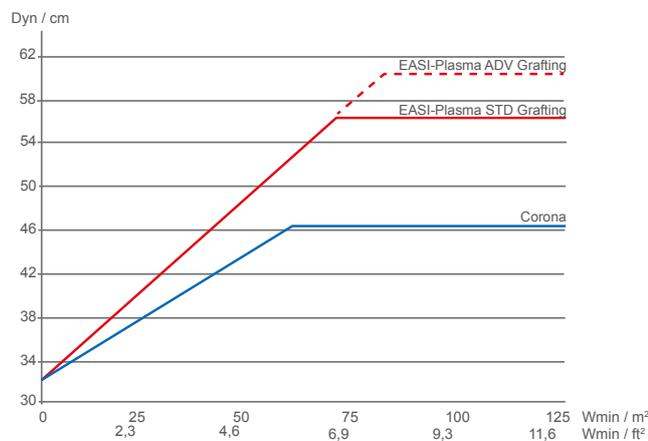


Corona is ideal for materials where oxygen-based molecule groups on the surface increase the adhesion, but a few materials have a limited reaction with oxygen owing to their chemical composition. Polypropylene and materials that have not been pre-treated upon extrusion fall into this category of “hard to treat” materials.

The solution in the past has been chemical; either by priming the material or changing the chemistry in the ink or adhesive so it could adhere to the material. This is both expensive and in most cases harmful to the environment and to the machine operators using the liquid solvent primers.

EASI-Adhesion solves these problems by changing the molecules on the surface to nitrogen-based instead of oxygen-based. The result is higher dyne levels and extremely good adhesion. As shown on the graph, 60 dyn/cm can be achieved on raw untreated BOPP, a widely used product that can not be printed or laminated with water based inks and adhesives, if purchased without primer.

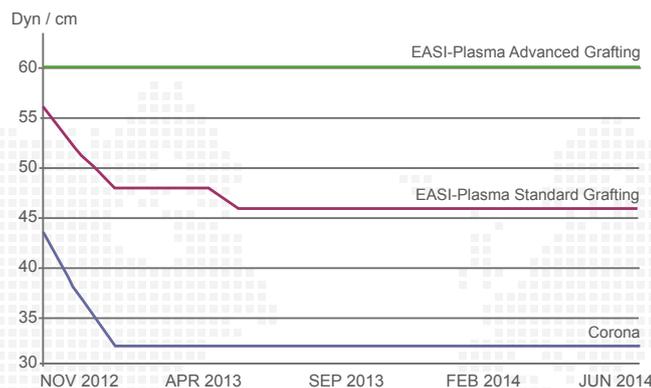
The benefits are not only a less negative impact on the environment and improved work environment for the operators, but also reduced costs per square area and a thinner final material.



Longer shelf-life has long been in demand in the converting industry. Usually it is recommended that materials are processed within 6 months of purchase. This causes additional expense owing to the logistic demands for internal handling and risks of having to scrap huge amounts of substrates.

Corona is the preferred method of preparing freshly extruded plastic film for later converting. However, regardless of how high a material factor [W·min/m<sup>2</sup>] has been applied to the material, it always decays over time. Depending on a number of factors like material type and the additives within, the decay can be measured from minutes, to weeks or months.

EASI-Anti Ageing solves this problem, as materials can be treated to high and lasting dyne levels guaranteed for 12, 18 or 24 months.



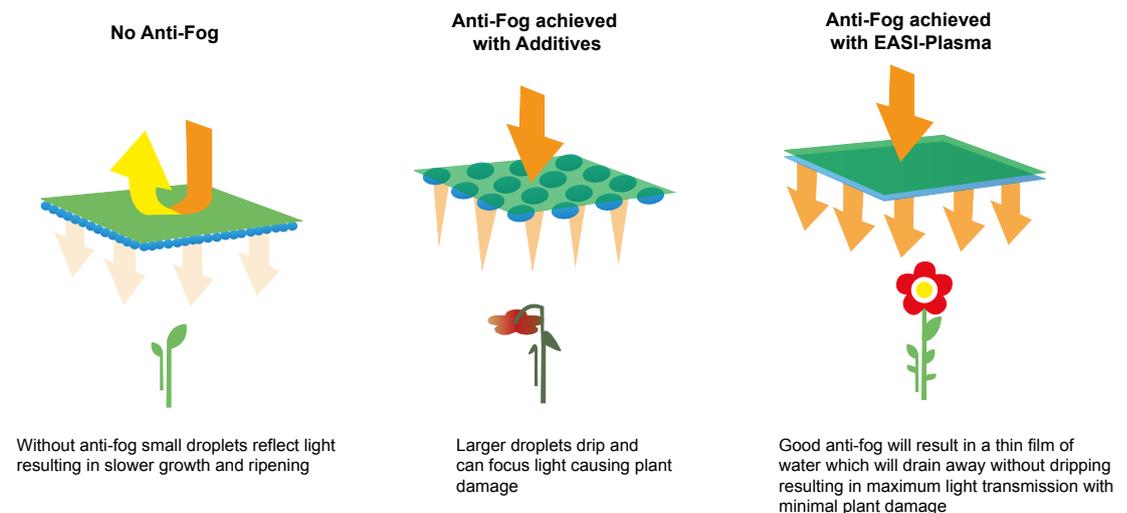


Avoiding fog on the surface of a transparent plastic film is very useful in food packaging and on films used for the agricultural industry, in green houses, on glasses and helmet visors.

An anti-fog surface will keep your products looking as fresh as when they were wrapped, increasing the shelf appeal, as it not only prevents fog but also gives the surface an exceptional transparency that is much better than the raw film.

Today anti-fog properties are usually created with additives to the formula when extruding the film. The additives react with the water vapour and change the surface tension of the water, not the surface tension of the film. The downside to this method is that the additives on the surface wear out and cause contamination of either the product in the food packaging, or the soil and the crops when used for agriculture or in green houses.

EASI-Anti Fog is a coating, that does not wear off with time and gives a uniform thickness layer.



If a droplet on a material forms a sphere where the contact angle is more than 90 degrees then the surface is defined as being hydrophobic, or water-fearing. The term defined as superhydrophobic is used for surfaces with a water contact angle of more than 160 degrees, which results in an extremely water-repellent surface.

The ability to repel water or other liquids can be extremely useful in a wide range of specialist industries, of which clothing and coverings are the most common.

EASI-Hydrophobic creates water-repellent properties by applying an extremely thin silicone coating. This nano thin coating can be applied to a wide variety of materials like plastic, paper and metal with the possibility of tuning the contact angle to exactly the degree that is needed (90° - 160°).



## EASI-Release

Controllable release properties are in demand especially in the label, tape and special adhesive products industries, where there is a need to control the peel force required to pull one surface off another.

Silicone covered materials have for decades been produced using traditional coaters that apply curtain, spray or print technologies but with EASI-Release the thickness of the silicone coated layer is only a fraction of the conventional coating.

Some of the big advantages of applying a thinner coating layer are a reduction in consumables and the elimination of the need for drying. This brings the running costs down to a level unmatched in the industry.

Besides lowering the cost per square area EASI-Release also provides the ability to tune the release properties to exactly the peel force needed for the products.



## EASI-Hydrophilic

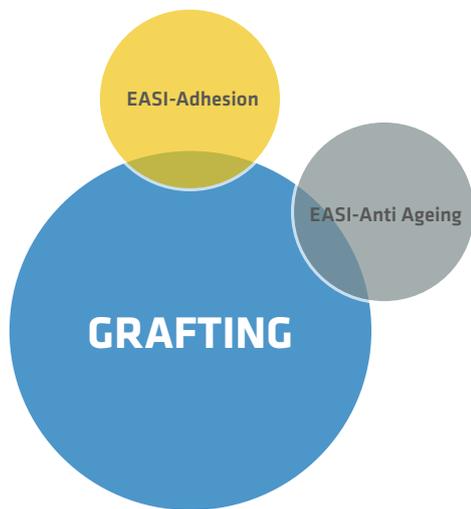
If a droplet on a material forms a sphere where the contact angle is less than 90 degrees then the surface is defined as being hydrophilic, or water-loving. The term defined as superhydrophilic is used for surfaces with a water contact angle of less than 20 degrees, where droplets spread out nearly flat.

A water absorbing surface is very useful for diapers and also water transferring and self-cleaning surfaces.

The hydrophilic properties are created by applying an extremely thin silica layer, which adds a permanent superhydrophilic surface ability with a tuneable low contact angle ( $5^{\circ}$  -  $20^{\circ}$ ). Furthermore it also provides the benefit of extremely good adhesion (72-105 dyn/cm).



# EASI-Plasma TECHNOLOGIES



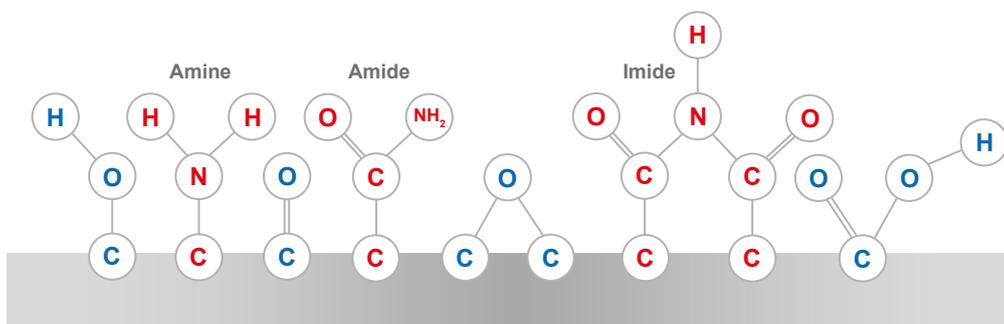
## EASI-PLASMA GRAFTING

EASI-Plasma Grafting shares some similarities with Corona treatment, as it is a Dielectric Barrier Discharge (DBD) created in a gap between an electrode and a roller. In this gap the molecule structure on the surface of the material breaks and forms new molecules depending on the composition of the atmosphere present in the gap.

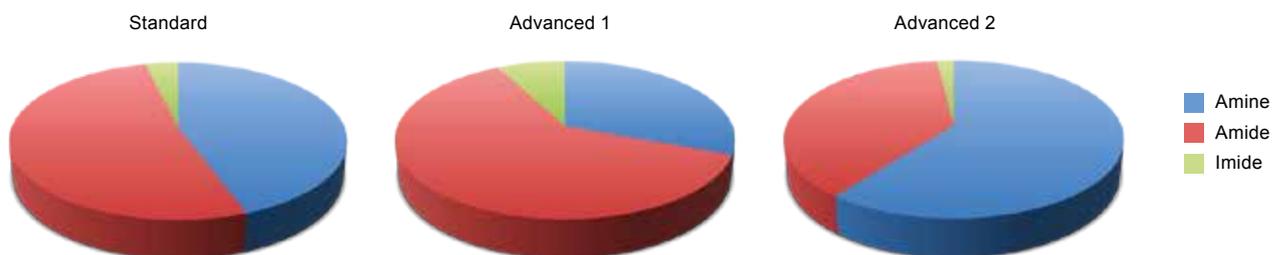
Corona treatment uses the air that is already present and what is interesting for many materials from a chemical point of view are the oxygen based groups (blue groups in the figure below). Whereas Corona uses the uncontrolled atmosphere that is all around us, Grafting uses a 100% controlled nitrogen based atmosphere, which instead creates nitrogen based groups on the surface (red groups in the figure below).

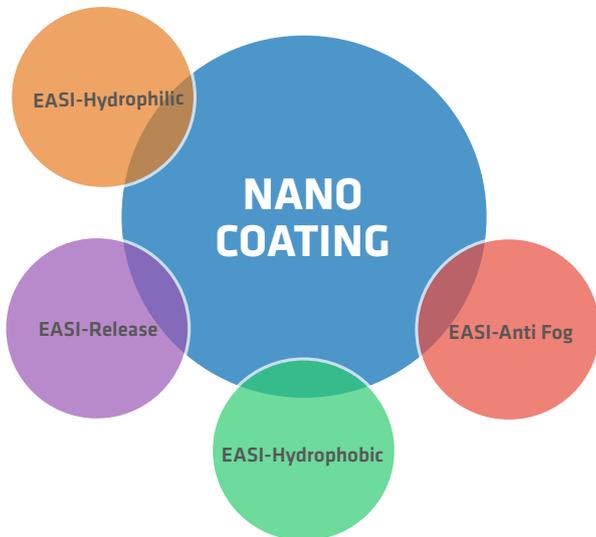
EASI-Plasma Grafting operates with a nitrogen based atmosphere that can be mixed with other gasses known as dopants, to create other groups, or to tune the quantity of the much desired Amine, Amide and Imide groups. For example higher quantities of Amine groups can be created by adding different dopants and thereby logically there will be less Amide and Imide groups. This way it is possible to tune the chemistry on the surface, not only to achieve good adhesion thanks to high dyne levels, but also to create chemical bonds to inks and adhesives that requires this.

The figure below illustrates the relationship between the creation of each of the Nitrogen molecule groups depending on the composition of the nitrogen based atmosphere.



What makes the EASI-Plasma Grafting so unique is the highly controlled atmosphere and the monitoring thereof. Unlike older technologies that have been present in the market since the 1990s, the EASI-Plasma technology is fully controlled and can be used in large-scale production systems as well as lab sized equipment.





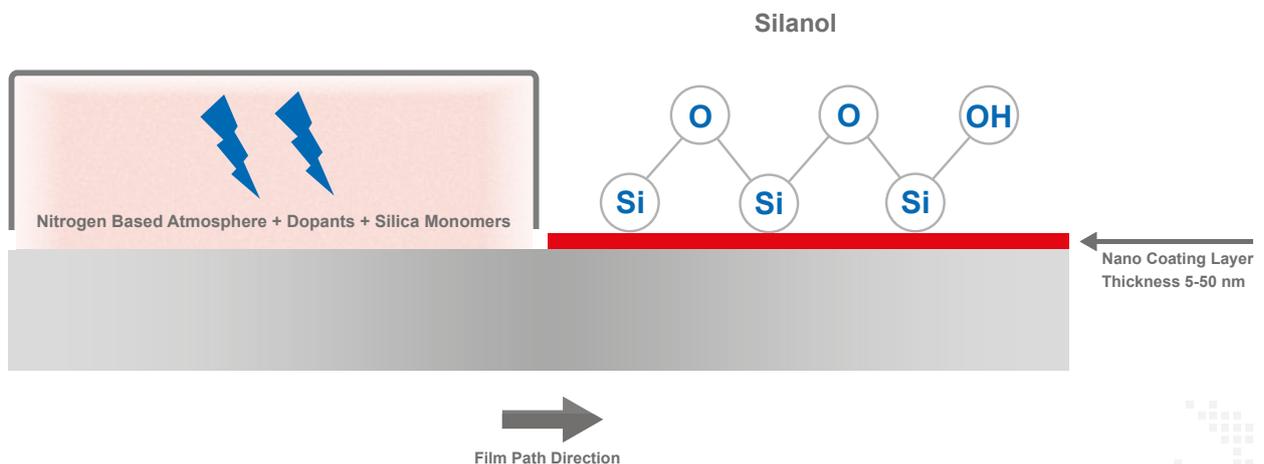
## EASI-PLASMA NANO COATING

EASI-Plasma Nano Coating is a much more complex process than EASI-Plasma Grafting. Although it is based on the same concept with a nitrogen based atmosphere, the atmosphere is balanced with vapourised monomers that enables ultra-thin coatings on most materials.

Typically coatings are silicone or silica based and can create a variety of properties on the surface, with layer thicknesses from 1 to 50 nm (0.001-0.05 microns). Compared to traditional coatings which at the very best can be as thin as 1 micron, the EASI-Plasma Nano Coating layer thickness is between 20-1000 times thinner than a traditional coating.

The advantages obtained are a reduction in consumables and the complete elimination of the need to dry the material after coating. This means that any type of converting machine can be equipped with an EASI-Plasma solution for inline coating.

The illustration below shows an example of how a Silica coating is applied to the surface of a film.

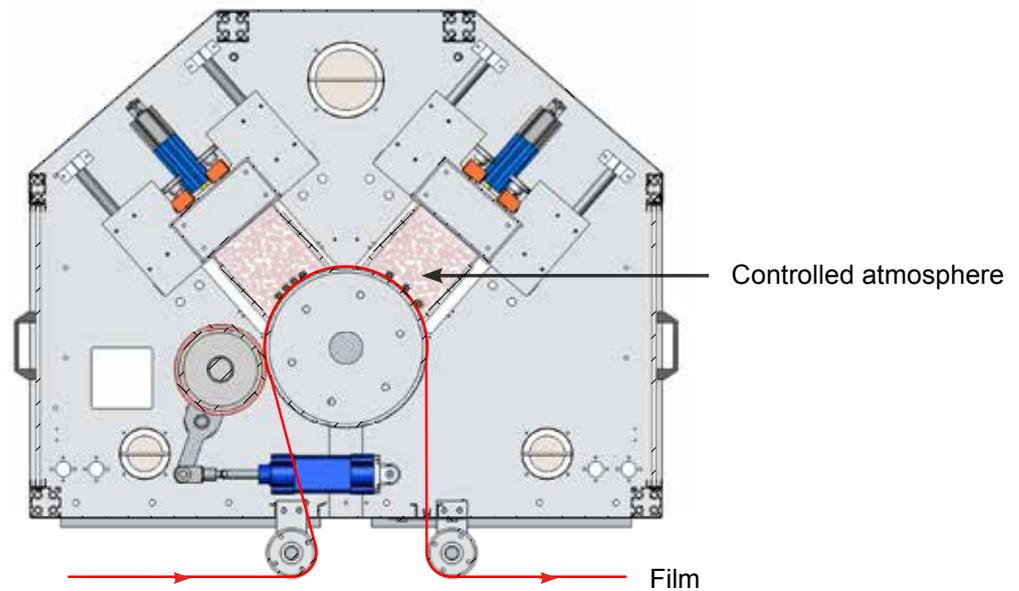


What makes the EASI-Plasma Nano Coating so unique is the highly controlled atmosphere and monitoring thereof, and the fact that the technology can be used in full sized production systems as well as lab sized equipment.

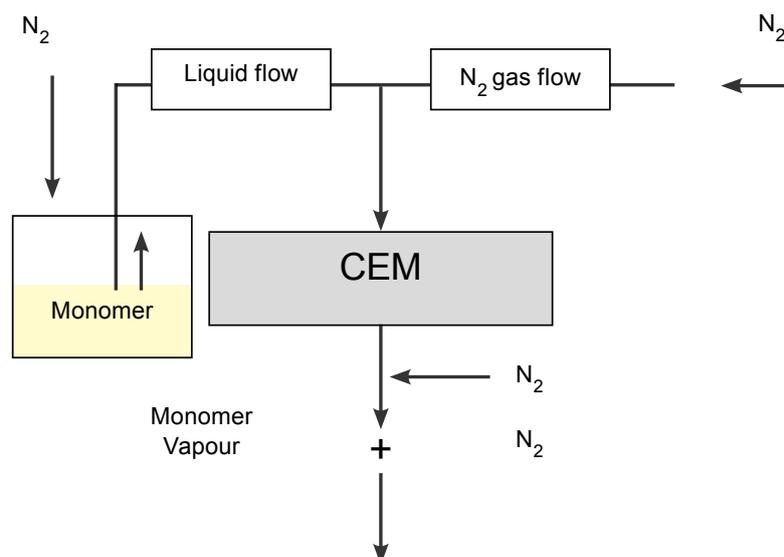
Vetaphone always offers a royalty free programme for all EASI-Plasma Technologies, so the customer can choose freely where to buy the consumables.

# EASI-Plasma for **HIGH END FILM**

The environmentally best way of creating a highly crosslinked structured surface with good adhesion.



The chemical plasma process is controlled by fine monitoring of the atmospheric pressure gaseous mixture in the plasma. A specific evaporation cell can be used for control of the monomer vapour injection.



The specifically used evaporation cell (CEM) enables a finely controlled injection of monomer vapour at low temperatures, reducing the possibility of vapour condensation in the injection lines

# PROOF OF CONCEPT

Before deciding to invest in an EASI-Plasma system, proof of the concept is the first step to ensure the best result. For this purpose, we have a test facility in Aix-en-Provence (Southern France) which contains two completely new installed test lines for EASI-Plasma surface treatment. The equipment is capable of running production speeds up to 300 m/min with a working width of 1200 mm.

The expert team of qualified engineers have advanced tools for analysis and control of surfaces like contact angle, surface energy measurements, specific O<sub>2</sub> and H<sub>2</sub>O permeation tests, and tests for adhesion and release. Furthermore we have a close partnership for advanced surface analyses (ATR-FTIR, AFM, XPS, ToF-SIMS, etc).

We have years of experience in test treatments and achieving excellent results based on our customers' needs. The process can be done with or without an NDA, depending on customer's wishes. Please contact your local representative or the Vetaphone sales team to order a complete test.

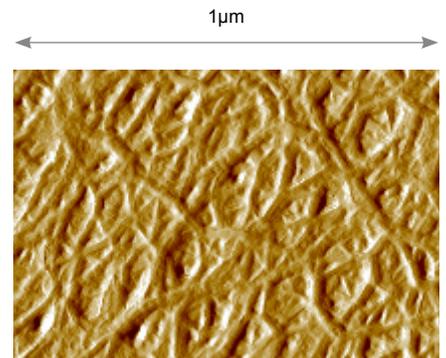
## Verified materials

The lists below are the materials, where we have already tested and verified that the different EASI-Plasma Technologies work. If your material is not in the list, it is still very likely that it can be treated successfully with EASI-Plasma.

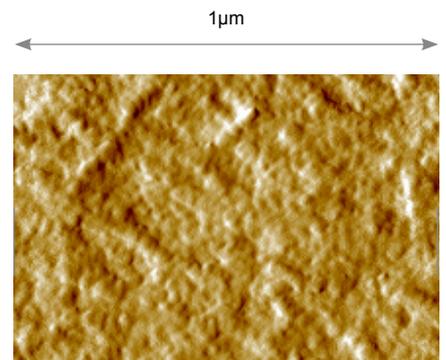
EASI-Plasma Grafting has been successfully performed on the following materials: PET, PP, BOPP, PE, PA, PVC, PVDC, Printed Polymers, Fluorinated Polymers (PVF, PVDF, ECTFE, ETFE, FEP and PTFE).

EASI-Plasma Nano Coating has been successfully performed on: PET, PP, BOPP, PE, PA, PLA, Paper, Metallic Foils or Metallised Polymer, Printed Polymers, Fluorinated Polymers (PVF, PVDF, ECTFE, ETFE, FEP and PTFE).

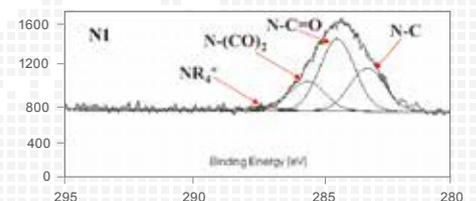
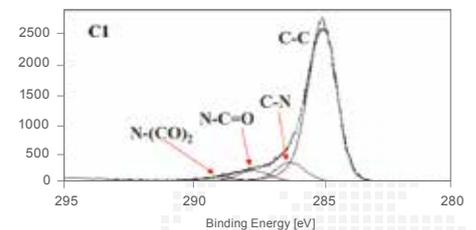
EASI-Anti Fog ability has been successfully achieved on the following materials: BOPP, PET, PP and PE



AFM image  
uncoated BOPP



AFM image  
EASI-Plasma silica coated BOPP



Nitrogen surface chemistry (XPS spectra)  
N<sub>2</sub> based EASI-Plasma treated BOPP

# SYSTEM OVERVIEW



# FEATURES

# BENEFITS



## Touch Control Panel

Our user friendly 10" LCD Touch control panel provides a graphical overview of the entire EASI-Plasma system. The intuitive display offers a large variety of automatic intelligent controls such as Substrate Matching, Gas Mixer Control, Production Log, Proportional Control, Maintenance Schedules and Digital Documentation.



## Gas Mixer Control

The important gas flow control and evaporation (CEM) system is controlled and tested specifically in order to secure the exact properties on the film. Interfacing the generator system enables complete production control.



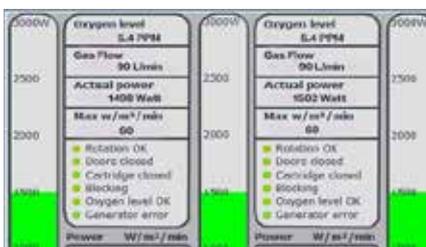
## Electrode System

Special designed Quick Change electrode cartridges secure a unique uniform dispatch of gases even at a ultra-low gas consumption. The Quick Change EASI-Plasma systems are constructed with optimum parallel discharge points, with perfect alignment, and can be supplied with metal electrodes or ceramic electrodes.



## Proportional Control

The generators are all equipped with proportional control related to power and line speed to ensure a constant Watt Density and constant Gas Density. Optionally, the control panel can display either the actual generator power output in kW, or the energy delivered to the substrate in Wmin/m<sup>2</sup> or Wmin/ft<sup>2</sup>.



## Oxygen measurement

To ensure the controlled atmosphere in the EASI-Plasma processes, our Oxygen measurement devices are of the highest quality in the industry. This means they are able to measure the strict demands for PPM level.



## Interface

The interfaces are used to integrate the system into the central process control making it easier for the operators to manage and understand the complete process line. Typically, all important parameters of the treatment and production data can be viewed graphically at the operator's main panel.

## Satisfied Customers

# WORLD WIDE

“ We have been really satisfied with the entire project. There was no hesitation signing an NDA, so we could get the project started. It was nice to finally work with a company that listened to our needs and made a solution for us.

The quick change system enables us to run with two different types of EASI-Plasma and at the same time normal Corona. The low consumption of gas is without a doubt the lowest we have been offered in the entire industry.

The EASI-Plasma solution has helped with our company's Green Profile. We have now replaced an environmental unfriendly process with EASI-Plasma. Not only are we saving a lot of money on our running costs, but even better, we have reduced our impact on the environment.

”

Explains Christopher Lloyd, NDA signed company.

[Read other customer statements on our website.](#)

[www.vetaphone.com](http://www.vetaphone.com)

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