

Leading in Sustainability & Productivity Improvements in Canmaking

UV Direct to Metal Systems

Background of UV Technologies

The development of UV technologies – a unique combination of materials formulation & curing equipment - represents the most significant advance in coating practice for many years. Although widely used since its origin around the '70s with paper and plastic materials, substantial effort has been needed to enable it to be used extensively in the metal decoration and protection field, and yet, after years of development, its full potential still has to be defined.

Many advantages have been reported on the use of UV inks and coatings in metal packaging. Let us highlight the most significant ones:

1. FAST CURING IN LESS THAN 1 SECOND

Under appropriate UV radiation, the UV coatings cure in **less than 1 second**. Coatings for thermal curing systems need at least 8 minutes.

Comparing the total time in the application process, the coatings for UV cure systems need maximum **15 seconds for completion**. In comparison, coatings for thermal cure systems need at least 20 minutes.

2. ENERGY SAVING UP TO 50%

Compared to conventional curing systems, substantial energy savings are realized, resulting in better **energy efficiencies**, hence is **more sustainable**.

3. LOW VOC'S FOR MORE SUSTAINABILITY

Coatings for UV cure systems have a low VOC, thus this is an extremely environmentally clean process.

For 100 kg wet coating, the average VOC and VOC floating out to the environment are **reduced by 48%** compared to coatings for thermal cure systems.

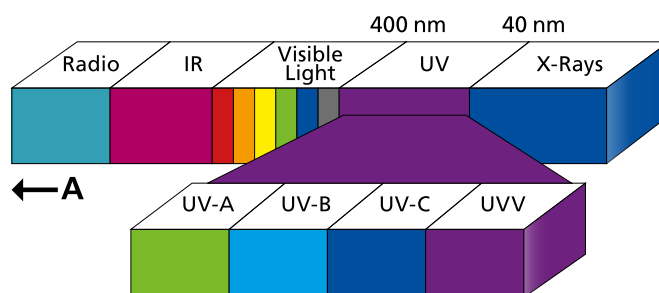
4. SMALLER FOOTPRINT

Due to the oven, the application line for UV curing systems requires less space compared to the conventional line.

5. FASTER PRODUCTION & LOWER COSTS

UV curing of a basecoat and one or more ink layers between presses avoids problems associated with wet on wet printing, which in turn reduces the number of passes needed in multi-colour printing.

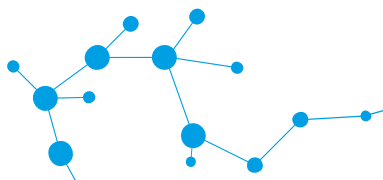
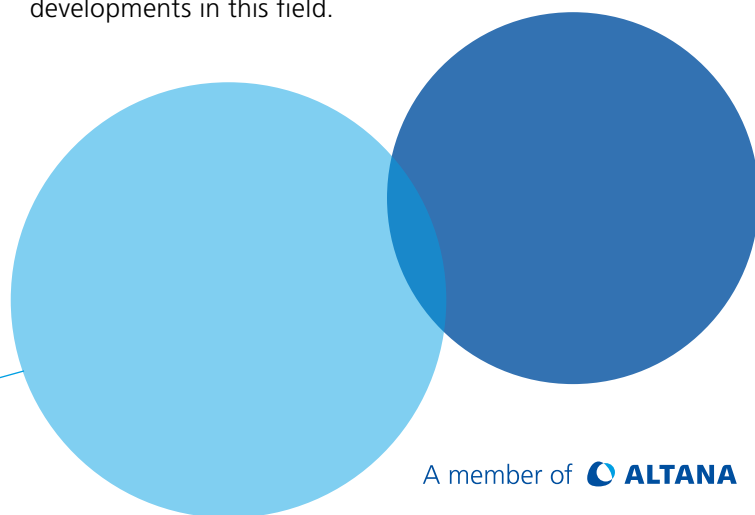
The wavelength of UV radiation



ACTEGA's unique UV coatings & inks portfolio

Making use of its broad industry knowledge and its UV technology competences, ACTEGA has been successfully partnering with the leading can-makers in Latin America to replace traditional solvent-based coatings with the UV systems. As a result of this move, the industry has been progressively achieving better industrial efficiencies (higher productivity, lower manufacturing costs, etc.) and more environmentally friendly operations due to reduction of VOCs released. In consequence, it is not a surprise that the use of UV-cured printing inks and overprint varnishes has been continuously increasing. However, due to the non-consistent performance of UV basecoats on Tinplate/Tin free steel, mainly caused by the variable quality of the different available metal sources, solvent basecoats have been the preferred coating until now.

Pursuing the sustainable can, (fully coated & printed with UV solutions) this has guided ACTEGA latest developments in this field.



With a deep understanding of can-maker processes, ACTEGA's development work starts with the selection of the safest, most legally compliant and performant raw materials, without losing cost consciousness of the final formulation. Photoinitiators, oligomers (free radical, cationic) and monomers are a vital part of UV coatings, as they are responsible for polymer cross-linking and film formation. They must be chosen with regard to their functionality, but also to their full integration into the coating matrix, so that migration is avoided and a smooth film enabled. This approach should be performed for all coatings and printing ink components, such as binders, additives, and pigments.

Thanks to its high dedication, ACTEGA offers a wide range of UV coatings based on cationic or free radical coatings – depending on the can design and final end use – and even, hybrid systems capable of providing high abrasion resistance. Gloss and matt versions of overprint varnishes, UV printing inks, and clear UV basecoats are already used in General Line and paint cans (bodies and components), aerosol 3 pieces, decorative cans, and new developments are already in the pipeline to bring additional value to its customers: EB (electro-beam) and LED curing coatings, UV food safe formulations and others.

Adhesion challenges of UV Systems

However, the adhesion and subsequently the performance of UV can coatings directly applied to the metal substrates has historically shown a few limitations:

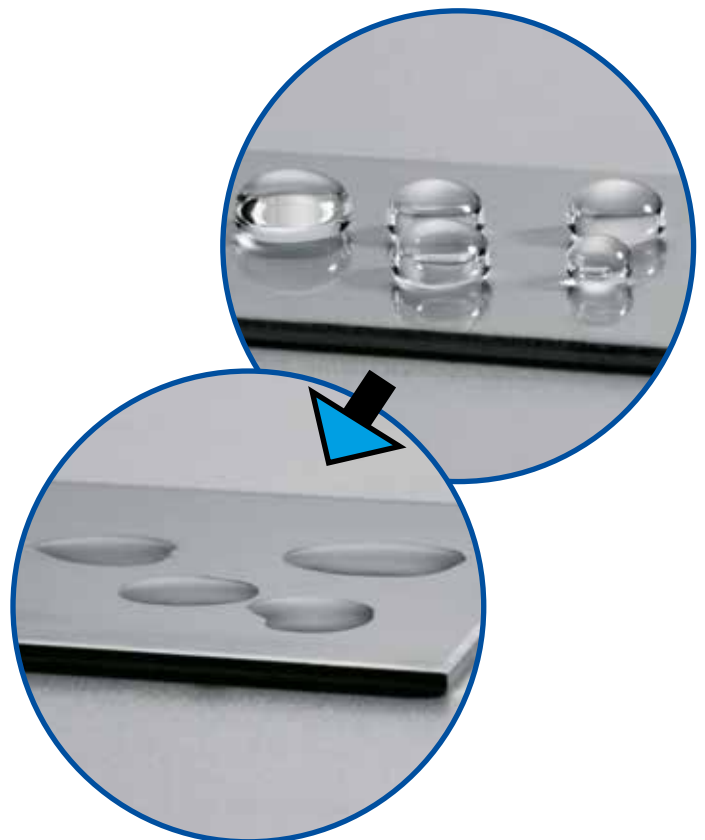
The variability of the Electrolytic Tin Plate (ETP)/Tin-Free Steel (TFS), Aluminum surface properties, can put at risk the strong adhesion of the UV coating to the metal substrate and the whole system performance.

As a consequence, UV techniques have been mainly used with printing inks and overprint varnishes applied on conventional solvent basecoats rather than on UV base/size coats. Let's have a look at the elements influencing the bonding mechanism of coatings to metal sheets in an attempt to figure out potential solutions for the industrial use of UV basecoats.

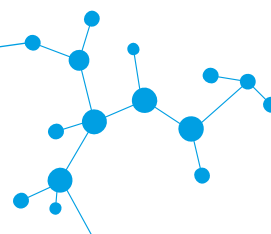
The strength of adhesion is not only determined by the coating material alone but substantially also by the nature of the metal surface:

- 1. The surface topography (roughness, size, solidity) determines the strength of a coating's adhesion, e.g. a rough surface displaying cavity-like structures has a higher interface with the coating and subsequently offers a higher number of bonding positions to the coating.**
- 2. The proper wetting of the entire metal surface is a prerequisite for improved adhesion. This is only achieved when the surface tension of the coating is lower than that of the substrate surface.**

WETTING POWER (SURFACE TENSION) OF A DROP ON A METAL SUBSTRATE

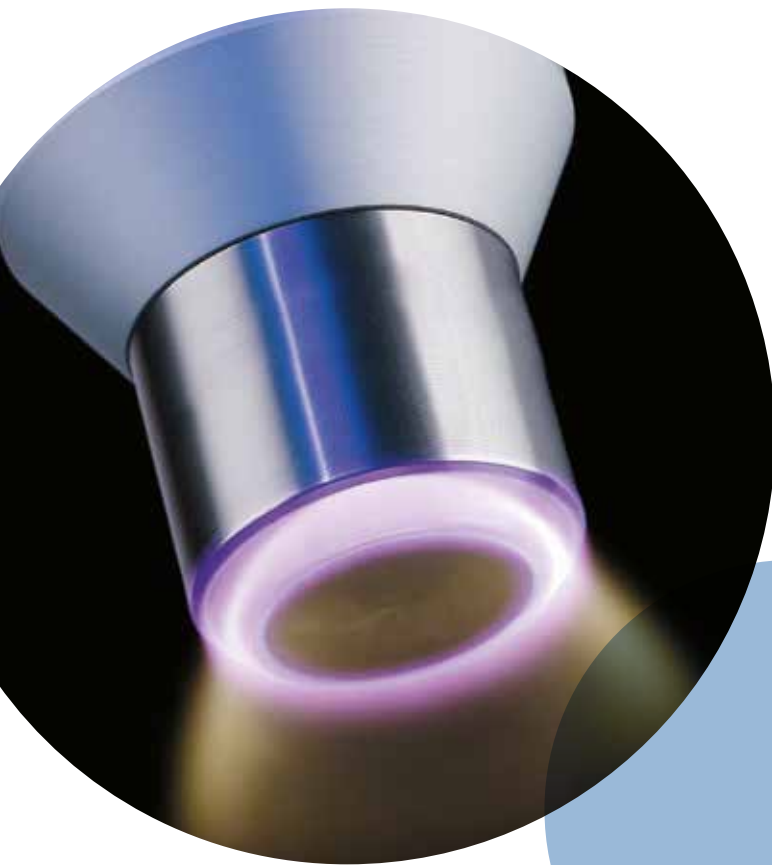


The cleanliness of the metal surface has also a great influence on the coating's adhesion. In their crude state, metals commonly used in the packaging industry are typically always covered with varyingly thick layers of oxides or anticorrosion products and protective oil. These impurities must be removed completely, if the proper coating wetting & adhesion strength is to be achieved.



The “Plasma” Solution

Having introduced the limiting factors associated with the industrial use of UV basecoats on Electrolytic Tinplate (ETP)/Tin-free Steel (TFS) and aluminum, the challenge for the can-makers is then how to achieve a perfectly clean and activated metal surface (independently of the ETP /TFS, Aluminum source) before the application of coatings. The coating producer will have to find out how to formulate a robust UV basecoat / size, lacquer, and ink with the highest possible wetting & adhesion power. Intending to define and implement the optimum industrial solution, UV coatings & inks expert, ACTEGA, equipment supplier Plasmatreteat, and general line can-maker Brasilata jointly created the basis for initiating a breakthrough project in Brazil.



Plasma jet from Plasmatreteat GmbH

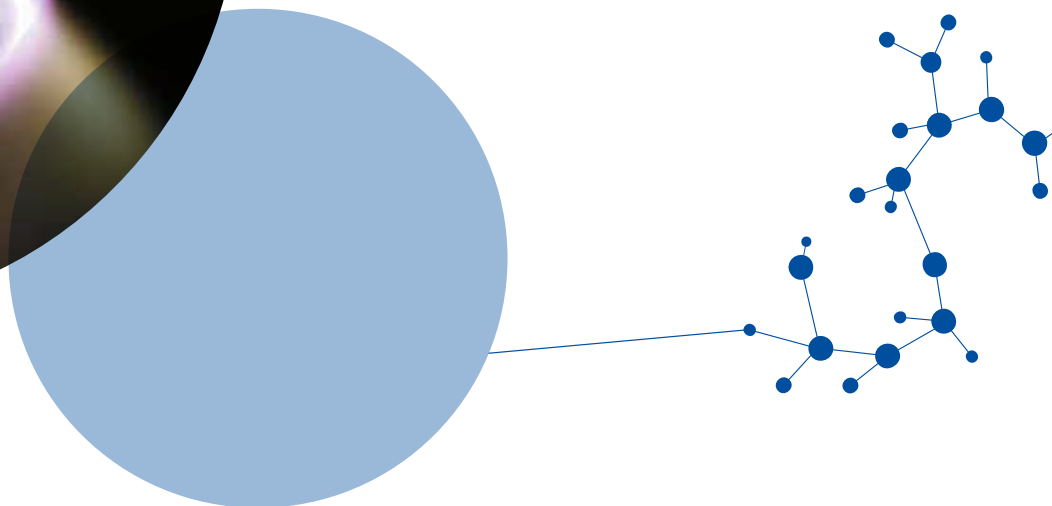
What is “Plasma”?

Plasma can be considered the 4th state of matter. Through energy supplies, solids become liquids and liquids turn into gas. If yet more energy is fed into the gas, it ionizes and turns into a gas containing neutral energized molecules as well as positive & negative ions produced from the original gas molecules. This is a very unstable state which is scarcely used at normal pressures. Nevertheless, utilizing the patented Openair-Plasma® process, the company Plasmatreteat has been exploiting since the mid-90s the industrial in-line use of this technology on a huge spectrum of substrates and applications – much more recently in the field of metal packaging coatings.

When plasma makes contact with the surface of metal, the energy in it is transferred to the substrate. This produces microfine clean metal surfaces that can easily allow wetting and adhesion of the UV coatings and/or printing inks.

Having in mind the full potential of plasma treatment in metal surface preparation as a bonding agent to promote adhesion of directly applied coatings, Brasilata initiated a development project to explore the benefits of this innovatively strong technology. This was done in combination with ACTEGA's direct to metal UV formulations, with full support from ACTEGA and Plasmatreteat, resulting in a patent of this innovative process.

In the context of the UV Direct to Metal coatings and the plasma metal pretreatment, the involvement of a can-maker was key to bringing the whole system to life. Not just at the laboratory level, but in a real industrial environment where the benefits and risks of such a technology could be easily validated. Brasilata has been instrumental in moving the whole project ahead.



About Brasilata

With an output of 50,000 tonnes of tinplate cans each year, Brasilata is one of the worlds most innovative can-makers. Chemical and paint cans account for 60% of its sales, aerosol cans for 30%, and the remainder is used for unprocessed foods like coffee or crown corks. The company attributes its success to the continuous innovations driven by its employees. Since the 1980s, a so-called "Simplification Project" has encouraged them to offer new design and product suggestions. With headquarters and a key plant outside of Sao Paulo, with other four operations in Brazil, Brasilata is now fully involved in building a highly efficient factory in Sao Paolo. With the criteria of minimizing the need for space for the coating-, printing-, and curing ovens, the company is pushing the use of UV technologies.

Brasilata is contributing to a startup company focused on innovative solutions for the metal decoration industry that will be responsible to assist the new partners in the world to implement the plasma metal pre-treatment process. With the system build from Plasmamatreat, and an exclusive formula from ACTEGA, this startup brings a clean and effective process that can change the game in UV coatings solutions.

In close cooperation, this new process will enable the direct application of UV Coatings on metallic sheets by enhancing the UV coating adhesion to the steel. After successful beta tests, this technology is proving to be efficient and promising, opening up a whole world of possibilities for sustainability and productivity improvements in can-making operations.

About Plasmamatreat

Plasmamatreat is the worldwide market leader in Atmospheric plasma applications for cleaning and activation of all kind of surfaces. You can find the Openair-Plasma® applications in automated production lines in almost any type of industry. Plasmamatreat has production centers in Germany (headquarter), USA, Canada and China and has more than 30 subsidiaries and partners around the world.

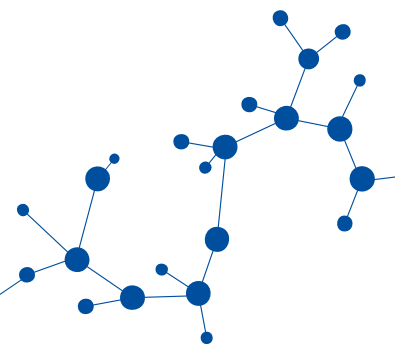
About ACTEGA

ACTEGA is a division of the internationally operating specialty chemicals group ALTANA. With production facilities in Europe, North and South America and China, ACTEGA develops, produces and distributes specialty coatings, inks, adhesives and sealing compounds with a focus on the packaging industry. Following the motto "Packed with Expertise", ACTEGA does not only offer technically sophisticated product solutions, but also meets the high safety standards of the food, beverages, pharmaceutical and toy industries. Whether for flexible and metal packaging, folding cartons or labels, products by ACTEGA provide packaging with a high-quality appearance and innovative functionalities.

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Plasma system for pretreatment of metal sheets



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