The zero-potential atmospheric-pressure plasma beam creates the ideal conditions for bonding tamper-evident security seals. Krones is a major customer of Plasmatreat, employing this Openair plasma technology on its labelling machines.

Innovative plasma technology resolves **problems in package manufacturing**

Hosted by ANDRÉ SCHLENK of Resin Processing Solutions, and addressed by CHRISTIAN BUSKE of Plasmatreat in Germany, a recent seminar explored the uses of Plasmatreat's Openair atmospheric-pressure plasma technology. GILL LOUBSER reports on the advantages of this exciting new technology for packaging production.

GROWING demands for compatibility with the environment present packaging converters with some tough obstacles. However, these can often be overcome by employing Plasmatreat's Openair atmospheric-pressure plasma technology.

Problems in packaging production are encountered when it comes to the adhesion of printing inks, sealing and bonding – because of the condition of the surfaces involved. Used for ultrafine cleaning and activation of surfaces, Openair plasma technology can ensure proper adhesion of water-based adhesives and printing inks, for which there's an increasing call in the packaging industry.

And now this exciting technology is available in South Africa, thanks to a meeting at K'2007 between André Schlenk, MD of Resin Processing Solutions (RPS), based in Hout Bay, Cape Town, and Christian Buske, CEO of German company, Plasmatreat.

Realising the considerable synergies between their companies, these two gentlemen decided to co-operate to promote Plasmatreat's offering in South Africa; and the first manifestation of this collaboration was a recent seminar at which Openair plasma technology was introduced to local players in a number of industries, including packaging.

So what's it all about?

Openair atmospheric-pressure plasma technology, developed and patented by Plasmatreat, allows microscopically fine cleaning and high activation of varied surfaces, promoting optimum adhesion of paints, inks and adhesives. According to Christian Buske, plasma cleaning is more economical and environmentally friendly than conventional pretreatment methods.

Based on a jet principle, the system operates at atmospheric pressure. With the aid of an electric arc ignited in the jet and the working gas (air), a plasma is produced which flows at zero potential on to the surface to be treated. It contains enough excited particles to produce selective effects on the surface.

The venue for the seminar was the office of Resin Process Solutions, nestled in the mountains above Cape Town's Hout Bay. Enjoying the sun with Gill Loubser were two sets of fathers and sons – RPS's Dominique Schlenk and his father André; and Plasmatreat's Christian Buske and his son Magnus.

A particular characteristic of the emergent plasma is that it's electrically neutral, which greatly extends and simplifies opportunities for its use. The intensity of the Openair plasma is so high that operating speeds of 100m/min are achievable.

The Openair system is characterised by a threefold effect. It activates the surface by selective oxidation processes, simultaneously discharges the surface, and thanks to high-speed air currents cleans off loosely adhering particles.

The jet systems employed can be integrated in-line into any new or existing production line.

Environmentally-friendly adhesion

The precision pretreatment and ultrafine cleaning of surfaces to be bonded using Openair plasma technology allows the use of modern solvent-free UV adhesives and water-based systems, even on surfaces that are highly resistant to adhesives, such as non-polar plastics.

This means that previously incompatible substrates can be made to adhere to one another. Additional pretreatment by chemical primers or wiping and washing surfaces can generally be eliminated; and as a result VOC emissions are prevented.

High production rates

Whether labelling jam jars, printing on glass containers, or sealing liquid packaging, a key factor in the packaging industry is the ability to process materials reliably and at low cost.

Pretreatment with atmospheric-pressure plasma makes it possible to process different materials and coatings that are sometimes very thin, for example, in the production of composite packaging.

Where packs are processed at high speed and an adhesive bond is required, recesses in the area of the bonding surfaces usually have to be taken into account, especially in the case of high-gloss plastic-coated surfaces.

By using Openair plasma technology, such high-gloss gluing points are directly and selectively pretreated in-line so that reliable bonding is ensured.

In labelling glass bottles, atmospheric-pressure plasma is employed for pretreating glass. This allows the use of a universal and low-cost water-based adhesive.

The secure bonding of longitudinal seams in high-grade folding boxes is made possible by pretreating the bonding surfaces with in-line plasma. For folding boxes with or without a crash lock bottom, and depending on the amount of adhesive applied, tracks 4mm to 8mm wide can be pretreated at high speed subject to jet geometry and requirements. The bonding seams or surfaces are activated by precision pretreatment, cleaned of organic residues and rendered wettable. At the same time, surface tension values rise to >72mN/m.

Plasma is not a flame but rather a 'cold beam'. This means that surfaces to be treated are not exposed to heat and the user can make use of standard and degradable adhesives. The treatment leaves no visible traces whatever on the surface. In the case of film-laminated blanks, a really tight long-term joint is achieved even when standard adhesives are employed. Line speeds of up to 400m/min and high cycle rates are attained by the plasma system using standard adhesives. The highly secure system, which the company has tried and tested worldwide, can be used for longitudinal seams, in crash lock boxes, for gluing windows in place or in erecting machines.

Towards the end of 2007, Plasmatreat and Swiss company Bobst concluded an exclusive global agreement in the field of folding box gluing (see article on page 15).

Plasma safeguards imprints

Imprints on packaging are diverse (eg best-before dates or EAN codes). In the food and pharmaceutical industries particularly, it's essential that such imprints are secure against abrasion.

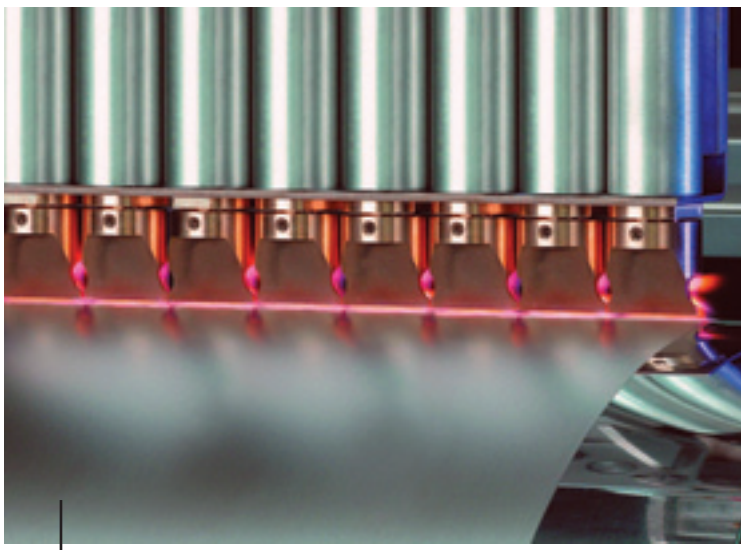
When applying decoration to glass bottles or jars for perfumes and creams, brilliant colours, precise colour matching and high pixel accuracy are required. Air bubbles must be avoided and optimum coating adhesion and high scratch resistance must be achieved.

Coated paper bags for warm fast foods require the secure holding of the cold-setting glue even though the contents may be hot.

Openair plasma technology fulfils all of the above requirements.

Treating flexible films

Polypropylene films are used for a wide variety of packaging applications and labelling. When such films require further processing – eg printed, laminated or metallised – the surface energy and the proportion of polar groups present on the film surface need to be increased in order to ensure satisfactory adhesion.



In-line jet tool for film activation. The atmospheric-pressure plasma guarantees one-sided treatment and so prevents jamming of the film on the roll.

Corona treatment, low-pressure plasma processes and flame treatment have been used for this purpose for many years. These well-known methods permit a comparatively modest activation but the effects deteriorate rapidly on storage. Moreover, corona treatment can lead to undesirable double-sided pretreatment which may result in the film jamming on the roll, while flame treatment considerably impairs a film's sealability.

The use of atmospheric-pressure plasma not only eliminates these disadvantages, it provides new applications.

In comparison with vacuum processes, atmospheric-pressure plasma has the advantage that the pretreatment can be integrated into existing film manufacturing processes and plants. The challenge posed by this project consists in the need to process films of relatively large width as evenly as possible at high throughput.

Plasma pretreatment of the cap ensures firm adhesion for wet-glue tamper-evident seals.

Labelling applications

One of the most common applications of Openair plasma in packaging is in the area of labelling. For advertising stickers, information labels or tamper evidence, there's always one key requirement: the glue must be water-based and the adhesive joint must not loosen by itself. When it's torn off a clear fibre tear should be evident.

To ensure adhesion of such labels, companies such as Kraft and other leading food and beverage manufacturers make use of plasma technology.

To sum up, the system is capable of in-line integration and is compatible with robots. Key advantages include the reliability and quality of this procedure in the production process. Other requirements such as simple integration into process workflows and higher efficiency in comparison with traditional methods are met while compatibility with the environment is outstanding.

For South Africa, André Schlenk sees enormous potential for this technology in the field of foam-in-place gaskets, electronic encapsulation, general bonding for household appliances such as ovens, and bonding in the automotive industry.

'But above all,' he concludes, 'there's significant potential in the printing and packaging industries.'

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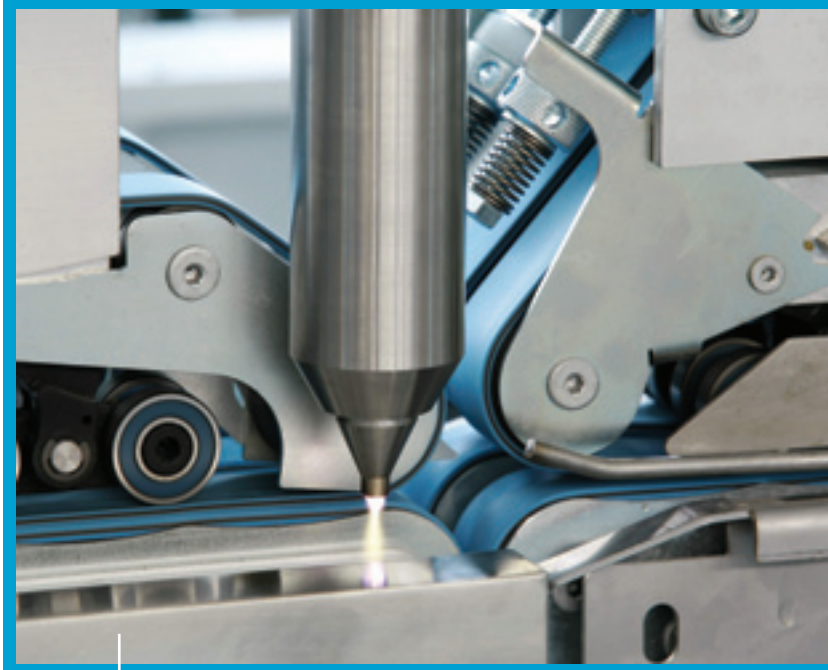
Bobst **signs up**



The 'cold' plasma beam ensures perfect bonding in high-grade folding boxes and leaves no visible traces on the surface.

BOBST has signed an exclusive deal with Plasmatreat to represent the company's Openair atmospheric plasma technology for packaging folding and gluing.

The technology is widespread in the automotive industry, where it has proven to be an indispensable tool for joining synthetic materials. The advantages of its use on plastic packaging, as well as on varnished, laminated or metallised paperboard, are numerous.

Surface tension is the key to joining synthetic materials such as plastics.

With low surface tension, for instance, small ink droplets form on the surface of the plastic substrates. Similarly, when applying glue to a laminated or varnished box, the bond is only strong at the points where glue droplets form. However, following plasma treatment, and the consequent rise in surface tension above 72mN/m, the adhesive adheres to the whole surface and forms a homogeneous high-strength bond.

Because surface tension drops in relation to the length a product has been in storage, it may fall to a level which makes it no longer possible to glue the material. For this reason the application of plasma treatment is carried out in-line, immediately before gluing.

The use of synthetic materials is widespread in the field of the high-value packaging, for instance for cosmetics. The gluing of these materials requires particular attention and there's strong interest in solutions that can reduce outlay on adhesives, while guaranteeing reliable gluing.

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