The Features and Benefits of Adding a Sealable Layer to Inkjet Media

Alan Hodgson
ILFORD Imaging UK Ltd.
Mobberley, Cheshire, United Kingdom

Abstract

Sealable Layer technology enables ink jet media to be printed and then surface sealed without the use of a laminating film. The sealing layer is incorporated during media manufacture. The media can be printed using standard inkjet systems and then sealed thermally to produce a resistant layer over the image. The application of such a sealing layer to ink jet media has many benefits for industrial printing applications. As an introduction, the principles of these sealing layers and the equipment required to use the system are described. The main focus of this paper is on the physical and imaging properties of this type of sealing media and the benefits these confer. The testing methods employed are also described. The advantages of this technology will be illustrated with reference to label applications.

Introduction

This paper describes a Sealable Layer that can be applied to a variety of substrates and sealed by a combination of heat and pressure. The substrates described here are a bond paper and an outdoor vinyl to illustrate how Sealable Layer features can add benefit to end user needs. The benefits are illustrated with reference to on-demand label printing but are not limited to this.

Principles of Sealable Layer Technology

This Sealable Layer can be applied to a broad range of substrates to make assemblies optimized for both dye and pigment inks. The layer comprises polymeric particles typically around 10-12μm diameter.[1,2] These are dispersed in a binder such as polyvinyl alcohol.[3] After printing the layer is sealed using a combination of heat (110º - 120ºC) and pressure (70psi), partially melting the particulate polymer dispersion such that it forms a film that imparts a robust image protecting coating. These relatively modest conditions compared to other technologies allows for faster processing speed and the incorporation of other features in the package.[4] Patents covering these other technologies are reviewed elsewhere.[5]

Finally, the use of Sealable Layer technology is not restricted to inkjet printing. Application to electrostatographic printing using toners is described elsewhere.[6]

The Equipment Required

The Sealable Layer can be incorporated into inkjet printable media that can be pigment and/or dye ink compatible and can be printed in standard desktop or wide format inkjet printers. The layer can then be sealed in devices substantially similar to desktop or wide format laminators. These devices comprise a means of heating and pressing a material, commonly by passing them through a nip between two heated rollers. This sealing process can take place on-line with the printer.

After sealing the result is similar in appearance and feel to a conventional colour photograph.

Comparison with Lamination

Sealable Layer technology competes with lamination as a way to protect inkjet images. Both offer protection from moisture and impart a robust surface finish to the print. Lamination does however require additional materials and can be expensive.

Lamination also adds strength and stiffness to a printed image. However, for label applications Sealable Layer technology offers a significant customer benefit as label stock can be die cut in production. This stock can then printed and sealed as described above but still applied without further cutting.

Properties of the Printed and Sealed Media

Security Features

With Sealable Layer technology an image receiving assembly can be designed such that the ink is retained substantially in the upper protective layer. This offers features distinct from lamination that translate into a number of user benefits. Firstly, residual solvents such as organic co-solvents that are frequently incorporated in aqueous inks remain trapped in the printed image after lamination. These can cause stain or migration of the image on storage[7] or reduced light fastness.[8] It is believed that any retained solvents are held in the lower receiving layers, thus separating them from the colorants and reducing these effects.[1]

Secondly, the presence of the image in the Sealable Layer has security benefits over lamination. Unlike a laminated image, attempts to remove the upper sealing layer will also remove the image. This confers the additional user benefit of enhanced protection against subsequent manipulation of the printed image.

Assemblies can also be designed such that the colorants reside in the underlayer, or be distributed between the layers.[2]

An additional security feature is that once the material has been sealed it is no longer receptive to ink. This means that it is difficult to alter and offers high levels of protection from fraud and forgery.

Gloss and Surface Features

Sealable Layer technology allows a high gloss to be achieved on otherwise non-glossy substrates. This also leads in general to a higher colour gamut.

Gloss level can be varied using the sealing parameters. No lamination film is required, only heat and pressure. However, additional benefits can be realized by using a release liner or embossed roller to modify the surface finish. For example, a high gloss release liner can be used to further increase the gloss of the final image. In addition, surface modification can be made by use of an embossed roller or release liner to impart further features. Examples include corporate logos and brand names, security features[5] and surfaces such as snakeskin or other patterns.[1] The use of a release liner allows selection of surface features on demand. This liner may be recycled almost indefinitely.

In some cases printed images can have a variation in surface gloss corresponding to different densities of colorant at different locations in the image area. It is therefore difficult to obtain the uniform gloss finish associated with a traditional photograph. Sealable Layer technology minimizes this effect, enhancing the attractiveness of a colour image.

Abrasion Resistance

The Sealable Layer imparts substantial abrasion, scratch and rub resistance even when wet. This feature can best be illustrated using pigment inks. A comparison of a traditional outdoor vinyl product with a vinyl incorporating a Sealable Layer shows substantially different abrasion characteristics. As described above, the image is locked into the sealing layer. This results in a significant gain in abrasion resistance. Abrasion levels that result in pigment transfer with traditional vinyl products only produce a slight matting of the gloss with Sealable Layer technology.

The customer benefit of this for applications such as packaging and labels is that the media retains its appearance, having less susceptibility to scuffing and rubbing.

Water, Weather and Fade Resistance

The sealed layer has a high water resistance. A sealed label on a paper substrate applied to a bottle is resistant to immersion in cold water for at least 5 minutes and to rubbing when wet.[2] The layer also confers resistance to other commonly packaged liquids.

When applied to an outdoor vinyl assembly this water resistance translates into superior weather fastness. In a similar fashion to the gains made in abrasion resistance, the Sealable Layer enhances the weather fastness of pigment ink by sealing it into the assembly.

Some benefits are also found in light fastness. In addition the Sealable Layer can be formulated to contain UV absorbers or light stabilizers to enhance stability.[2]

Dye based inks printed onto porous substrates are known to be prone to fading by a number of agents, notably airborne gaseous pollutants.[9] Application of a Sealable Layer to a porous substrate such as bond paper also confers substantial protection to gas fading.

The customer benefits of these attributes are that labels sealed with this technology show enhanced resistance to challenging user environments.

Conclusions

Sealable Layer technology allows a total solution procedure to be implemented to the printing and sealing of high impact colour inkjet print and apply labels with high image quality.

The sealed layer imparts a durable abrasion, liquid and fade resistant surface. The assembly also has a number of interesting security user benefits.

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Biography

Alan Hodgson has a BSc and PhD from the Department of Chemistry of the University of Manchester Institute of Science and Technology. He joined ILFORD Imaging in 1982 working in Image Physics R&D on optical instrumentation and testing methods. After a number of technical support and Sales & Marketing roles he is currently Manager of the Technical Services group in the UK, covering both traditional silver image and emerging ink jet technologies.