

New Thermal Dye Transfer Printing Applications by Using an Intermediate Transfer Printing Method

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Abstract

Thermal dye transfer printing technology has found acceptance in many areas, including medical photo imaging and other high-speed digital photo applications. Generally the technology brings the end user a number of advantages. However, up until now, a drawback has been the severe limitations in the type of usable substrates (usually only treated PET film or a surface coated with chemically similar resin). Another drawback has been the security of the attachment of the OP layer which, while strong, is not such as to make it impossible to remove, exposing the dye layer. This disqualifies thermal dye transfer printing from use in sensitive or secure ID applications. Both of these problems are solved, and the gateway to many more applications is opened, with the introduction of the intermediate transfer recording method (hereafter referred to as INTM).

The principle of the INTM process is that the dye image is formed on a receiving layer (as in 'conventional' thermal dye transfer printing). Unlike this more familiar method, instead of an over-printed protective layer, a heat seal layer is next printed. (The INTM sandwich contains the equivalent of the OP layer found in conventional thermal dye transfer ribbons.)This heat seal layer can now be used, with a heated pressure roller, to attach the receiver layer to a wide variety of desired materials, including paper, stickers, plastic materials, flat sheets and curved surfaces.

New applications for the INTM method have been developed, including the printing of Christmas cards, birthday cards, and novelty stickers.

Introduction

The thermal dye transfer printing method has been expanding into an increasing number of applications with its qualities of high resolution, dry process, and quick output digital image data[1)]. Applications include video printers, medical printers, publication proofing printers, ID-card printers, sticker printers, digital photo printers and so on.

The quality and the light stability of thermal dye transfer-printed images and silver halide photo images are on the same level. However, the receiver used for thermal dye transfer printing has been (as opposed to other print technologies such as ink jet) a highly specialized paper.

The requirements for the properties of thermal dye receiving papers include the following:

1. The receiving paper needs to be composed of a base sheet and a dye-receiving layer.
2. The surface of the receiving paper must be smooth.
3. The base sheet should be composed of a cushion layer and a support sheet.

Up until now, these facts have severely limited the applications in which thermal dye transfer printing could be used.

INTM

After much investigation, we would now like to propose the INTM. The INTM is similar to conventional thermal dye transfer printing, but after the dye image is formed on the receiving layer a heat seal layer is printed on top. On heating with a pressure roller, the heat seal layer, which possesses excellent adhesive capabilities to the receiving layer, can be attached to a wide range of other materials with an exceptionally strong bond. It should be stressed that the dye is then transferred to the desired material *along with the receiver layer*. Furthermore, the dye is now to be found at the junction of the heat seal layer and the receiving layer. Therefore, whereas a conventional thermal dye transfer image is protected from damage by just its protective layer, the INTM image has not only a protective layer, but most of the width of the receiving layer to protect its dyes.

The fact that the receiving layer is very weak but now very strongly attached to the heat seal layer means that any attempt to alter an INTM image will probably lead to its destruction.

Figure 1 shows the INTM cross section. Figure 2 shows the panel pattern of the dye ribbon with the heat seal.

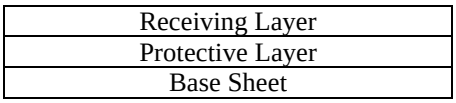

Figure 1. Cross Section of INTM

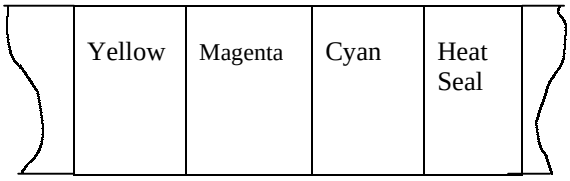

Figure 2. Panel Pattern of Dye Ribbon with Heat Seal

The process of the INTM is as follows:

1. The dye image is formed on the receiving layer.
2. Next, the dye image is covered with the heat seal layer, transferred from the ribbon by the thermal head.
3. The heat seal layer is fused to the desired surface.
4. Base sheet of INTM is easily detached to leave finished product.

Advantages of INTM are described as follows:

1. Using INTM, a dye image can be formed on a wide variety of surfaces. These include various different types of papers (including rough-surfaced paper), plastics, thick materials and curved surfaces.
2. Edge-to-edge printing is very easy with INTM. Any part of the receiver layer/protective layer that does not become attached to a surface with the heat seal layer will stay attached to the base sheet.
3. The dye image formed from using INTM has high durability because the dye image is covered with a protective layer. Furthermore, the side of the receiving layer that has been dye-permeated is the one furthest from the surface of the protective layer.
4. The strong attachment of dye-permeated sections of the receiving layer to the heat seal layer makes alteration of an INTM image very difficult, thus raising this technology's security performance above that of conventional thermal dye transfer printing.

Figure 3 shows the process of INTM.

New Applications

We would like to propose the following new applications.

Soft Sticker

The traditional thermal dye sticker, found increasingly in novelty photo booths and in other applications, is made of PET film with a receiving layer. The stiffness of a PET film sticker is very great, and it is thus unsuitable to stick it to a curved surface. On the other hand, soft materials, such as natural papers and soft PVC, that are suitable for attachment to curved surfaces, cannot be directly printed using thermal dye transfer printing. However, the dye image using the INTM can be attached to various stickers made from soft materials.

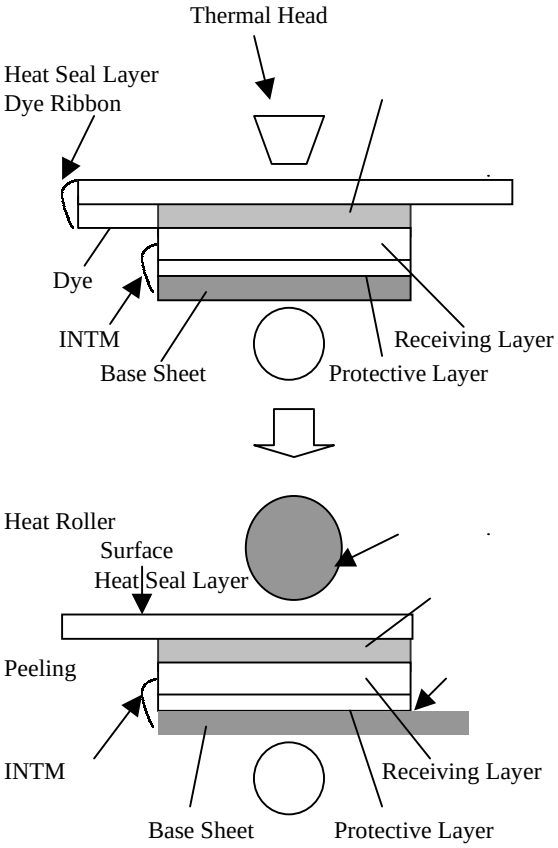

Figure 3. Process of INTM

The sticker naturally comes into direct contact with the fingers. Although finger grease can cause dye within the receiving layer to run, the INTM image has its protective layer, giving the sticker high durability. (N.B. This application is highly appropriate in Japan, where teenagers, especially girls, tend to plaster their pencil cases, mobile phones and nearly everything else with this type of sticker.)

Clear Material Media

Using a conventional thermal dye transfer-printed image on clear materials is unsatisfactory, due to the image's insufficient optical density when used on these materials. However, the optical density of the dye image

using INTM is good. The image formed on clear material using the INTM is very well defined.

Furthermore, clear material media is often displayed at a window, and there is clearly a call for light stability. The protective layer offers UVA and also prevents any plasticizers from reaching the dyes, thus giving the INTM image light stability and durability.

Applications for clear material media include OHP, clear sticker and so on.

Post Card, Christmas Card and Birthday Card

The image on a post card, Christmas card or birthday card calls for an attractive design, but an ordinary thermal dye transfer image will always be set in a blank frame; edge to edge printing, with ordinary thermal dye transfer printing, is very difficult.

The INTM is excellent for edge to edge printing, as it is easy to create, on the receiver layer, an image larger than the final image that the user wishes to see. The advantage of the INTM is that the any part of the receiver layer which is not attached to a surface by the heat seal layer will remain attached to the INTM base sheet.

Trading Card

The trading card is very popular all over the world. However, the thick card generally used for these cards is an unsuitable medium for conventional thermal dye transfer printing. While there are printers for thermal dye card printing, they are expensive.

The dye image using INTM can be placed on materials such as the card stock used for trading cards. The INTM, therefore, presents a means of creating a thermal dye transfer-printed trading card that is inexpensive and has high resolution.

Summary

INTM can be applied to a wide range of materials, thus broadening thermal dye transfer printing's adaptability. Various existing applications of thermal dye transfer printing can be enhanced, both in terms of performance and aesthetically, by using INTM.

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References

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Biography

1985-1991 Tokyo-Denki University. Majored in applied physics; 1991-1992 Dai Nippon Printing Co., Ltd. Information Media Laboratory Working on thermal imaging media Dai Nippon Printing Co., Ltd. Information; 1992-1998 Media Laboratory. Working on thermal dye transfer media; 1998 Dai Nippon printing Co., Ltd. Information Media Supply Division.