

An Overview of Sublimation Printing



Sublimation refers to the **physical process** through which a **material** changes from a **solid** to a **gas** without first becoming a **liquid**.



Sublimation printing may reproduce images on any flexible or rigid receptive substrate surface that can withstand the amount of heat, pressure and dwell time necessary for image transfer.

What Is Sublimation?

Sublimation refers to the physical process through which a material changes from a solid to a gas without first becoming a liquid. Sublimation printing involves dye that sublimates or sublimates with the addition of heat from a solid to a gas that penetrates into a sublimation dye receptive material. Polyester is by far the most widely used sublimation dye receptor. One can also sublime to some other polymers including Nylon 66, polyvinyl, polyethylene and fluoro-polymers, including Tedlar®, and Teflon® protective films and coatings. The transfer temperature must also be below the point where a receptor polymer will deform or combust.

Sublimation Print Methods

Most analog and digital printing technologies print sublimation dyes. Typically, lithography and screen printing account for the analog methods used, and inkjet, electrophotography in the form of laser and electrostatic printing, and thermal transfer

account for the digital methods employed. Lithography, screen printing and inkjet print a liquid containing sublimation dye and solvent onto a transfer paper as a mirror image of the intended final design. After the print dries, then one can place the image in contact with a polymeric fabric or coating and transfer it with the addition of heat and pressure for a period of time. Laser electrophotography employs sublimation dye as the colorant in dye-charged polymeric toner. Electrostatic printing uses a sublimation dye in a liquid toner. The fusing stage turns the powdered and liquid toners into dry solid mirror images. Thermal transfer sublimation printing can either create a transfer like other print methods as a mirror image or print directly to a sublimation receptive surface, a process called dye diffusion. The former method transfers the mass of sublimation dye in a wax carrier coated on a polyester carrier at a temperature sufficient to transfer the wax-dye ink without sublimating the dye. The photographic development and identification industries use dye diffusion with thermal print heads that can produce gray scale photographic images.

Ink manufacturers produce sublimation inks for offset, screen printing and inkjet; toners for electrostatic and electrophotographic printing; and ribbons for thermal



By **Vince Cahill**, President, VCE Solutions.com.

transfer. Paper manufacturers offer transfer papers designed for each of these print methods. One manufacturer indicates that it offers digital transfer papers compatible with narrow- and wide-format water-based inkjet printers from Epson; wide-format printers from Mimaki, Mutoh and Roland; solvent-based printers from NUR and VUTEk; and oil-based printers from Xerox. Other printers similarly built with Epson, Xaar, Spectra or Konica, in addition to Hitachi, Toshiba-tec, Seiki Instruments, PicoJet, IJT, OTT, Trident or Marsh print heads printing similar sublimation inks can successfully print system compatible sublimation dyes with these existing transfer papers. Océ's line of Arizona printers, Gerber's Elan and Jetster printers, and the non-UV curable DGI and Azero printers among others can print sublimation dyes although their manufacturers may not support their use.

Inkjet printing offers a range of print resolutions for both disperse dye and sublimation printing. The systems with micro dot Epson print heads can produce 1,440 dpi resolution gray scale photographic images at print speeds under 100 ft²/hr and, for some printers, production output of over 300 ft²/hr at 360 dpi.

The 3M company supports the use of sublimation toners from Specialty Toner Inc. of New Jersey with its Scotchprint 2000 electrostatic printers. Production models of the Scotchprint 2000 deliver 400 x 400 dpi resolution prints at production speeds of over 1,900 ft²/hr. Beta Color (formerly BMT) of Ontario, California offers a similar Scotchprint system with toner from Hilord Corp. For applications where 400 dpi is acceptable and production speed critical, these systems offer the digital solution. Electrostatic printers require transfer papers with a dielectric coating. InteliCoat and Sihl produce electrostatic transfer paper.

Sublimation Dye and Inks

Sublimation inks are chemically similar to disperse dye. One can print disperse dye onto transfer paper then transfer the image to polymers in much the same way one would with sublimation dye.

Sublimation inks come in a variety of molecular weights. Generally, lower molecular weight dye will prove more fugitive and require lower temperature to accomplish transfer, while higher molecular weight dyes will better resist exposure to sunlight and require higher transfer temperatures. One would employ lower molecular weight dyes for heat sensitive substrates and higher

molecular weight dye for longer outdoor print durability. Be sure to ask a sublimation ink supplier for this information when choosing a product.

Currently available digital printing methods use three-, four- or six-process color printing for most sublimation applications. Often, printers will use spot colors from their own color kitchens with analog sublimation printing. Spot color printing can produce colors that lie beyond the gamut that process colors can replicate. Tools such as sophisticated and accurate color management software, spectrometers and ink-media-printer profiling may assist in duplicating millions of distinct colors with process color, however, process colors cannot reproduce many colors that customers want.

Sublimation Transfer Paper

While one may print sublimation inks to plain paper and transfer images to sublimation receptive surfaces, paper manufacturers have designed some transfer papers to yield optimal results. Sublimation dye will sublime in all directions unless otherwise restricted during transfer. Paper manufacturers have developed silicate paper coatings that capture sublimation and disperse dye and release and direct the vaporized dye using silicate coating in a polarized fashion toward the print surface. Transfer papers such as those in TexPrint95 and Jetcol HTR series are designed to dry quickly and resist cockling during inkjet printing. These papers enable higher color saturation with less ink. Transfer paper optimized for sublimation printing can lower ink use and expense, thus offsetting the higher cost of optimized transfer paper while producing superior print quality results. Paper companies optimize different papers for the variety of inks and print methods. They offer papers for printing with solvent-, oil-, and water-based inks, and for use with lithography, screen printing, inkjet, laser electrophotography and electrostatic printing.

Sublimation transfer paper requires careful handling to ensure that its coating will maintain its performance characteristics and not degrade. One should keep the paper in its protective packaging until used, return unused portion to its packaging, store it in 40-50% relative humidity, allow paper to achieve normal room temperature before using, and do not expose to heated or air-conditioned currents.

Applications for Sublimation Printing

The growth of sublimation printing has relied on the prevalence of polyester and

other sublimation receptive materials and coatings. Polyester represents the second most favored fiber after cotton in the U.S. and the first for the rest of the world. Polyester fabrics comprise a wide range of apparel items including sports shirts, jackets, coats, blouses, shirts, pants and dresses, in addition to mouse pads, and sports caps. Polyester liquid and powders coatings cover metals, wood, plastics, ceramic, leather, glass and stone. In addition to polyester, sublimation and disperse dye can also color some polyamide, polyethylene and polyvinyl polymers.

Many suppliers carry a wide variety of promotional and gift products featuring sublimation printable coated aluminum, fiberboard, hardboard, cement board, fiberglass and plastic items. Items include T-shirts for sublimation reception, beverage insulators, polyester calendars, polyester patches, cloth banners, apparel, auto upholstery, flags, pennants, banners, building wraps, gaming table covers, sails, tablecloths, carpet, speaker covers, fabric displays and fabric covered structures, tabletops, clock faces, skis, ceramic tile, ceramic plates, mugs, and tiles, appliance fascia, fire resistant plastic, backlit signs, hardwood flooring, coated medium density fiberboard (MDF) hard board coasters and clipboards, metal panels and wood surfaces. The opportunities go on and on.

In short, sublimation printing can reproduce images on a world of flexible and rigid receptive substrates that can withstand the amount of heat, pressure and dwell time necessary for image transfer.

Sublimation Materials & Supplies

Sublimation Heat Transfer Presses

Small scale:

Hix Corporation

Pittsburg, KS 66762 USA
Phone: 620.231.8568
Toll-Free: 800.835.0606
Fax: 620.231.1598
Web site: www.hixcorp.com

Geo Knight & Co.

Geo Knight & Co Inc.
Brockton, MA 02301 USA
Phone: 508.588.0186
Toll-Free: 800.525.6766
Fax: 508.587.5108
Web site: www.geoknight.com

Insta Graphic Systems

Cerritos, CA USA
Phone: 562.404.3000
Toll-Free: 800.421.6971
Fax: 562.404.3010
Web site: www.instagram.com

A.W.T. World Trade Inc.

Chicago, Illinois 60641 USA
Phone: 773.777.7100
Fax: 773.777.0909
Web site: www.awt-gpi.com

Stahls'

St. Clair Shores, MI, USA
Phone: 586.772.5551
Toll-Free: 800.521.9702
Fax: 586.772.6237
Web site: www.stahls.com

Practix

Acworth, GA, USA
Phone: 770.974.1480
Fax: 770.974.1584

Large scale:

Monti Antonio SPA

THIENE, Italy
Phone: 0445 364619
Fax: 0445 364033
Web site: www.montiantonio.it

Adams International Technologies

Ball Ground, GA, USA
Phone: 770.479.1900
Fax: 770.479.4179
Web site: www.adamsintertech.com

Electrostatic Toner Manufacturers

Hilord Chemical Corporation

Hauppauge, NY, USA
Phone: 631.234.7373
Toll Free: 800.645.1022
Fax: 631.234.4597
Web site: www.hilord.com

Specialty Toner Corporation

Fairfield, NJ, USA
Phone: 973.575.3643
Fax: 973.575.9626
Web site: www.specialtytoner.com

Inkjet Sublimation and Disperse Dye Ink Suppliers and Manufacturers

Tropical Graphics Inc.

Oakland Park, FL, USA
Phone: 954.351.9311
Fax: 954.351.5592
Web site: www.tropicalgraphics.com

BASF Corporation – Headquarters

Ludwigshafen, Germany
Phone: +49 621 60 93606
Fax: +49 621 60-93806
Web site: www.basf.com/textile U.S.A.
Charlotte, NC, USA
Phone: 800.545.4931
Fax: 704.398.5044

DyStar Textilfarben GmbH & Co.

Deutschland KG
Frankfurt, Germany
Phone ++49 69 21 09 27 34
Fax ++49 69 21 09 20 05
Web site: www.dystar.com

Keystone Aniline Corporation

Chicago, IL, USA
Phone: 312.666.2015
Toll-Free: 800.522.4DYE
Fax: 312.666.8530
Web site: www.dyes.com

Lyson Limited

Stockport, England
Phone: + (44) 0 161 442 2111
Fax: +(44) 0 161 442 2611
Web site: www.lyson.com

Manoukian-Argon Ink Division – LECHLER SPA

Luisago, Italy
Phone: 39-031-9090160
Fax: 39-031-920505
Web site: www.lechler.it

Rotech

Ikast, Denmark
Phone: +45 97153977
Fax: +45 97156301
Web site: www.rotech-digital.com

Sawgrass Technologies

Mount Pleasant, SC, USA
Phone: 843.884.1575
Fax: 843.849.3847
Web site: www.sawgrassink.com

Thermal Transfer Ribbons

IIMAK offers sublimation ribbons under a license agreement with Sawgrass Technologies.

IIMAK

Amherst, NY, USA
Phone: 888.464.4625
Fax: 888.329.0260
Web site: www.iimak.com

Sublimation Transfer Paper Manufacturers

Beaver Paper and Packaging Inc.

Atlanta, Georgia, USA
Phone: 770.935.5080
Toll-Free: 800.768.2700
Fax: 770.935.5090
Toll Free Fax: 888.768.2700
Web site: www.beaverpaper.com

Coldenhove

Eerbeek, Holland
Phone: +31 313 670 670
Fax: +31 313 670 680
Web site: www.coldenhove.nl

Qualimage

Cham, Switzerland
Phone: +41 (0) 41 785 33 44
Fax: +41 (0) 41 785 33 45
www.qualimage-swiss.com

Electrostatic Transfer Paper Manufacturers

InteliCoat Technologies

(formerly Rexam)
Hadley, MA, USA
Phone: 413.536.7800
Toll-Free: 800.343.0818
Fax: 413.536.4414
Toll-Free Fax: 800.861.4128
Web site: www.intelicoat.com

Sihl (now part of the Diotec Group)

Zürich, Switzerland
Phone: +41 1 205 4313
Fax: +41 1 205 4414
Web site: www.sihl.ch