

UV LED'S IMPACT IN THE SPECIALITY PRINTING MARKET

Stacy Hoge looks at examples of this curing technology in practical applications

Ultraviolet LEDs (UV LED) are taking their place as a mainstream curing technology in many different printing applications. Rapid technological advancements by UV LED manufacturers, ink formulators, and machine builders are being made in all areas, from digital ink-jet to flexography, screen, and even offset, demonstrating the far-reaching potential and growing acceptance of UV LED curing. This article provides real world experience from a printer using UV LED curing and looks at inks and machines now available for UV LED curing in specialty printing applications.

Advances in UV LED lamp technology and UV screen-printing ink formulations have proven LED curing as a viable alternative to medium-pressure mercury lamps. UV LED light sources are ideal for high-speed curing in screen-printing applications such as roll-to-roll, container decorating, sheet-fed, and many more. Let us take a closer look at one printer who was an early adopter of the technology for their operations.

THE EMPIRE EXPERIENCE

Empire Screen Printing located in Onalaska, Wisconsin innovated screen-print methods with the introduction of the first UV LED curing screen-printing press of its kind in the United States. Empire is an industry leader in screen-printing, flexography, digital printing, and doming, employing more than 200 in its 14,000 square m (150,000 square ft) manufacturing facility. It collaborated with Nazdar and Phoseon for three years beginning in 2008 to develop a UV LED screen-printing solution. The result was the Kammann K-61 Eco-Press, a 368mm (14in) wide roll-to-roll press equipped with five cylinder print stations combined with flat screen technology and UV LED curing, which offers enhanced flexibility, precision, and quality. Installed in 2011, the Eco-Press holds a colour registration tolerance of 0.1016mm (0.004in), unheard of in the screen-printing industry. In addition, less operating heat prevents material distortion, making rewinding and re-registering colours easy.

The complete in-line printing process offers many advantages over traditional sheet-fed printing, including the completion of parts from start to finish in a one-piece flow, reduced material waste, and fewer handling errors. This results in shorter production time. Compared to sheet stock, roll stock is less sensitive to dust and contamination, resulting

in fewer rejects and has a thinner liner, reducing material waste that is thrown in the garbage or landfills, and it is less expensive.¹

UV LED curing technology uses significantly less energy, requires no outside venting, and has no ozone emissions. John Freismuth, president at Empire says: "The cost to run a traditional UV press, based on 5,000 hours, is \$34,351/year. The cost to run a UV LED press is \$658/year. The annual energy savings alone paid for the additional cost of the UV LED lamps." Freismuth says they were replacing the mercury bulbs every 1,000 hours, about every one to three months, but he fully expects to get ten to 14 years out of the LED lamps, especially since they only operate for 1 second out of every 7 second printing cycle. And the low heat from the UV LEDs means they can print on a variety of heat sensitive substrates and no longer need to use a fiberglass conveyor belt. A less expensive rubber belt works just fine with no static charge issues.

Building on this success, Empire has since installed two additional screen presses with UV LED including a three-colour carousel press. Empire built up this press themselves, using air-cooled, 8W/square cm UV LED lamps. The air-cooling eliminates the need for a water chiller using only plant floor air to cool the lamps.

WHERE LED MAKES SENSE

Freismuth says that for them it absolutely makes sense to retrofit UV LED onto small-format screen presses, 368mm (14in) wide and less. For new machines up to about 635mm (25in) wide it also makes sense to use LED instead of mercury because the cost difference is easily offset by the energy savings. But, on these wider machines, it is currently cost prohibitive to

retrofit them to LED given the sunk costs in the existing lamps and the cost to retrofit. Empire's operation is currently about 40% LED with the plan to convert all machines over to UV LED eventually. The UV LED lamps play a key role in Empire's commitment to sustainability and the environment. In June 2013, Empire was endorsed by the State of Wisconsin as a Green Tier 1 company for their superior environmental performance. It also received an SGIA Sustainability Recognition Award.

When asked about any issues getting screen inks that will work with the UV LED lamps, Freismuth noted that for the first year heat was needed on the roll-to-roll press to get adequate surface cure. But now heat is no longer needed because the ink formulators developed UV LED curable inks with adequate surface cure, even in roll-to-roll applications running at 50.3m (165ft)/sec where rewinding uncured inks would be a serious issue. The company currently has five UV LED screen ink suppliers and has no issues getting inks to meet its production needs.

"The result of the collaboration between Nazdar, Empire, Phoseon, and Kammann is a milestone in the future of screen-printing," says Phil McGugan, Nazdar's global vice president of sales and marketing. "Empire has proven that adopting LED technology is a key to increasing productivity, reducing cost, and decreasing its impact on the environment all in one stroke. Contributing to this cutting edge solution by developing multiple screen-printing inks was imperative for Nazdar in support of the industry."

CONTAINER DECORATION

Curing screen-printed inks on plastic and glass containers is an ideal screen-printing application for UV LED because of the small

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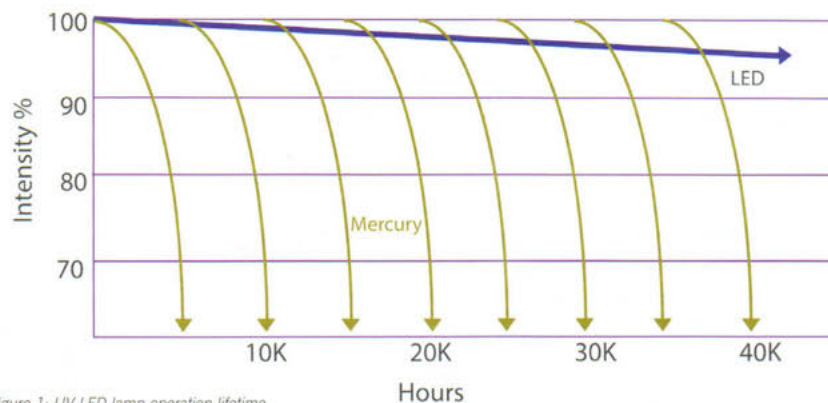


Figure 1: UV LED lamp operation lifetime

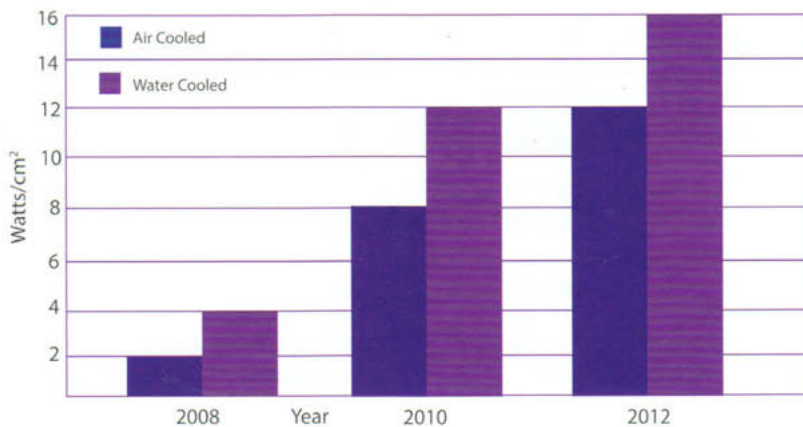


Figure 2: UV LED system over time

print area and need for a compact curing unit that can easily fit into the printing machine. For example, in October 2012, OMSO SpA debuted a container decorating machine which can print up to eight colours on multi-shape plastic and glass containers using UV LED curing. The decorating machine is capable of production speeds up to 90 pieces/minute while delivering accurate colour registration and energy savings of 50% compared to previous versions. Most of this energy saving is due to the high efficiency and instant on/off capability of the UV LED lamps.²

Serigraphie Richford Inc, based in Quebec, Canada specialises in printing and decorating glass containers to create distinctive packaging for its spirits, health and beauty, wine, cider, beer, bottled water, soft drinks, and food customers. Serigraphie utilises UV LED light sources for curing inks on glass containers to improve the quality of print.³ The UV LED lamps also contribute to the company's sustainability efforts since LED lamps contain no mercury and save significant energy.

LED LAMP LIFE-TIME

UV LEDs have a lifetime of more than 20,000 hours of 'operational on' time and beyond if they maintain proper operating temperatures. UV LEDs have a very long life-time so the traditional issue of replacing a bulb every 2,000 to 4,000 hours is removed (see figure 1).

Phoseon Technology has life tests with more than 40,000 hours of 'operational on' time with minimal decrease in intensity. For example, at 20,000 hours of 'operational on' if the curing unit is on eight hours/day x five days/week x 50 weeks/year (2,000 hours/year) it would last for at least ten straight years.

UV LED PERFORMANCE

Prices for UV LED lamps continue to come down even as their output increases, making additional applications feasible both technically and economically (see figure 2).

UV LED system output is four to six times what it was just six years ago. This opens up new opportunities for business owners with fixed-head UV LED arrays.

LABEL AND NARROW WEB

Comparing Labelexpo Europe 2013 (held in late September) to Labelexpo Europe 2011 proves just how rapidly the industry has adopted UV LED technology. More than 80 UV LED curing lamps were installed on equipment at the 2013 show, up from ten instances during the 2011 show. Curing uses ranged from pinning to full cure and many of the machines were 100% UV LED based.⁵

The EFI Jetrion 4950lx LED printer represents a new level of digital label production systems, with improved four-colour, 720 x 720 resolution in addition to speeds of up to 48 m/minute and advanced LED curing. The Jetrion 4950lx printer's higher image quality, finer text, and wider colour gamut expand capabilities to take on more primary label applications as well as pharmaceutical and nutraceutical labels. Its LED technology provides a competitive edge by enabling printing on heat-sensitive and speciality substrates. EFI predicts substantial cost savings of 100/job just from labour and reduced substrate waste, compared to analogue flexo equipment even on short-run jobs.

BRaille PRINTING

AB Graphic international recently introduced a digital printing machine for Braille which incorporates UV LED curing. The machine is primarily aimed at the production of pharmaceutical labels, leaflets and booklets and can also be used for any packaging markets where Braille marking is required. Printing Braille allows for better personalisation and flexibility for labels and packaging. To change the message frequently, such as date, name, or language, the press operator simply updates the computer running the line. A traditional stamping method requires installing a new pair of wheels for each change. In addition to personalisation and flexibility, the new printing line allows for higher quality printed Braille on the packaging. This makes the labels easier to read with more language differentiators. The system utilises UV LED curing with a high-

viscosity ink 200 microns high that cures at up to 40m/minute, which makes it ideally suited for use within a pharmaceutical environment.⁵

During Labelexpo Europe 2013 Gallus and Siegwark gave live demonstrations of a new UV LED screen-printing ink (Sicura Flex LEDTec and Sicura Screen LEDTec) for relief varnish suitable for screen-printing raised warning labels for the blind and visually impaired on packaging with hazardous contents as required throughout Europe (EN Standard 272 or ISO 11683).⁶ The Gallus EM 280 press was equipped with five flexographic units and one screen unit all cured by UV LED lamps.⁷

3D TEXTURED PRINTS

Direct Color Systems (DCS) offers the Direct Jet 1024UVHS UV LED flat-bed printer, a high-speed, small-format ink-jet printer that utilises in-line printing and produces breakthrough 3D textured prints. These UV LED printers are extremely versatile, offering a printable area of 254 x 610mm (10 x 24in) and prints on substrates up to 152mm (6in) thick. They produce incredibly crisp text and vibrant, full-colour images with outstanding solvent and abrasion durability on a variety of substrates, from wood and metals to ceramic tiles, plastics and glass. Typical applications include cellphone covers, industrial part marking, dial and gauge faces, promotional items, and plaques.⁸

VARIABLE DATA PRINTING

The Domino K600i is a high-speed digital black plate UV LED ink-jet system that prints 600dpi variable data up to 75m (246ft)/minute onto a wide range of uncoated and coated sheet or web materials. Applications include printing seamless alphanumerics, logos, graphics and 100% scannable Grade A verifiable bar codes onto labels, tags, tickets, forms, security products, and direct mail. Automated print-head maintenance functions eliminate the need for human intervention, which has the potential for damaging print-heads and maximises uptime. Users of this printer benefit from fast make-ready, less material waste, and excellent print quality. The air-cooled UV LED lamps increase production speeds and reduce energy use contributing to the lower cost of ownership.⁹

Paul McGovern, sales manager USA at Mimaki comments: "Lower power consumption saves money on power bills, and low-temperature curing with LED works well for heat sensitive substrates, especially in graphic overlays. LED lamps can last more than five years. Print-head assemblies are lighter. Advancements in ink, fast start-up times, and printing on a variety of substrates (leather, synthetics, soft films, medical device logos, markings) have all opened up new markets."¹⁰

AWARD WINNING FLEXOGRAPHIC UV LED TECHNOLOGIES

Another recent development is UV LED flexographic printing. During Labelexpo Europe, Mark Andy and Flint Group were honoured for their nearly two years of joint development to make UV LED narrow web flexographic printing an available mainstream technology for converters and printers world-wide. Mark Andy was honoured with the prestigious 'Award for Innovation' for delivering a UV LED curing system called ProLED while Flint Group won an 'Award for Innovation' for their development of EkoCure UV LED printing inks. This printing system can print pressure-sensitive labels and unsupported films, 254 to 444.5mm (10 to 17in) wide, at speeds up to 230m (750ft)/min while delivering in excess of 50% in energy savings compared to traditional mercury lamps.¹¹

FIXED-HEAD APPLICATIONS EXPANDING UV LED CURING

As discussed here ink formulators, press manufacturers, and machine builders continue to innovate and collaborate to move UV LED technology into new applications. While UV LED originally made inroads in wide-format ink-jet applications where its small form factor lent itself naturally to the moving head platform, we are now seeing fixed-head LED arrays for small-format applications. As UV LED costs decline and output increases, there is no reason to doubt that UV LED will expand into medium-format printing and other applications due to the energy savings, production quality, environmental benefits, and overall cost savings. ■

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LED OVERVIEW

Issue 2 / 2013 of this magazine included a 'Focus on LED' feature and issue 3 / 2013 offered contrasting information. For an overview of this topic, these articles can be downloaded at www.specialistprinting.com

ANNIVERSARY EXHIBITION SETS RECORDS ACROSS THE BOARD

Labelexpo Asia reaches new visitor heights

Labelexpo Asia 2013 reached new visitor heights as it celebrated its tenth anniversary edition. Held at the Shanghai New International Expo Centre (SNIEC) during 3 to 6 December, the four day exhibition was attended by a huge number of high quality visitors to see the largest ever floor plan of exhibitors.

Welcoming 21,416 visitors, Labelexpo Asia 2013 achieved an increase of 18.8% over 2011's show which attracted 18,019 attendees. Visitors came from 87 countries, up 11% from 74 countries in 2011. Covering 8,500 square m of net space, with just under 300 exhibitors, the show was larger by 10% versus the last event and also experienced its highest ever onsite level of space rebooking for 2015.

Many leading international and Asian companies exhibited including Avery Dennison, Epson, Gallus, Lintec (Suzhou) Tech Corporation, Omet, Nuova GIDUE, UPM Raflatac, Xeikon, Zhe Jiang Wei Gang Machinery Co and Zhongtian Machinery Works Co. There were more than 70 running machines being demonstrated. New products unveiled for the Asia Pacific region included Screen's Truepress Jet L350UV digital label press, Avery Dennison's TurnLock Laminating System and Brotech's new turret rewinder with automatic core take-off. Nuova Gidue's innovative M3 digital flexo press was a major attraction with packed demonstrations.

WELL-ATTENDED CONFERENCE PROGRAMME

A two-day conference programme ran alongside the exhibition and featured six well attended sessions. Topics included digital printing, beverage labeling and the importance of innovation. The opening keynote was delivered by Jukka-Pekka Haapanen, vice president Asia Pacific at UPM Raflatac, who gave an overview of the latest global trends and market forecast.

John Davy, show director of Labelexpo Asia comments: "This has been the perfect way to mark the show's tenth anniversary with Labelexpo Asia 2013 being the biggest, busiest and best edition to date. We've had fantastic footfall with exhibitors reporting plentiful and strong sales leads while the exhibition floor and conference sessions have been packed for the duration of the event. We've also managed our highest ever rebook with 50% of space already confirmed for 2015 which is highly unusual for Asian exhibitions.

"This year's success is a key indication that China's economy is showing clear signs of recovery and is picking up pace. With so many market leading suppliers and manufacturers on board, there can be no doubt in the minds of the Chinese converting industry that this is the must-attend show for the label and package printing industry." ■

Further information:

web: www.labelexpo.com