UV LED FOR PEAK PERFORMANCE AND SUSTAINABILITY

Using UV LED curing technology for screen printing can improve production efficiencies, particularly for printing on cylindrical objects. Stacy Hoge looks at the advantages of UV LED over traditional curing methods

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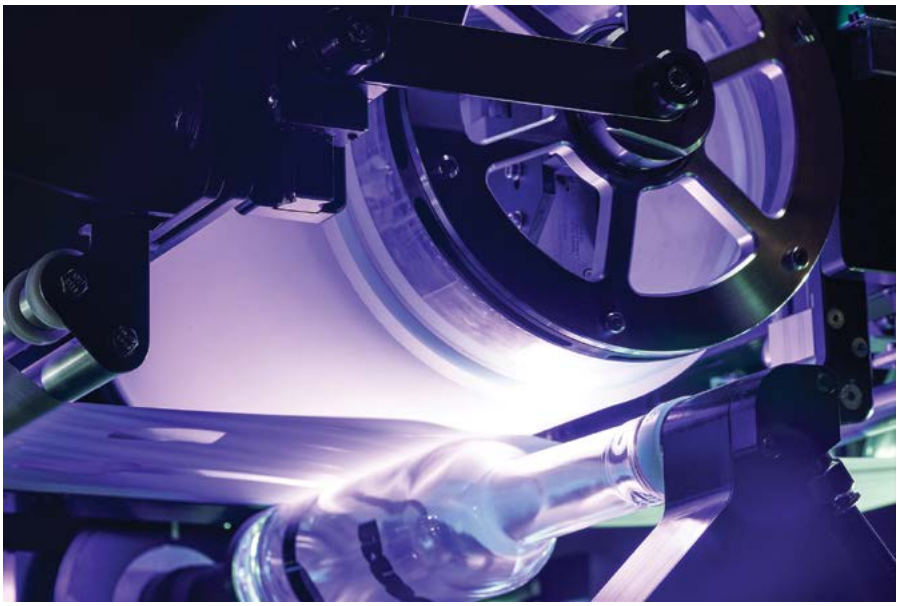

UV LED offers significant advantages over traditional UV curing for screen printing. Photo courtesy of Isimat

UV LED curing technology is a great fit for screen printing, in applications such as the printing of glass, plastic bottles and closures. The technology offers significant advantages over traditional UV curing for screen printing, including smaller and lighter lamps, less maintenance and downtime, which translates into higher productivity rates, better adhesion on pigmented products, less scrap and higher quality end products at lower costs.

The use of traditional UV lamps to cure inks on heat-sensitive substrates, such as plastic cosmetic objects, can result in deformation. UV LEDs allow high adhesion on covering inks, enabling strong colours on the more difficult substrates. Due to narrow, high UV-A wavelength, UV LEDs produce significantly less heat. The UV-A wavelength also allows for a more penetrative cure, which is an advantage when faced with thicker sections.

DIRECT PRINTING APPLICATIONS

Screen printing can be used for applications such as glass, closures, metal bottles and plastic cosmetic bottles. Compared to mercury UV, LED has a high UV-A wavelength that reduces heat-related damage to materials and substrates. LED is also effective for curing thick sections, allowing high pigmented white controllable power output.

Traditional UV lamps produce light by generating an electric arc inside an ionised gas chamber (typically mercury). After the atoms in the gas chamber are excited, they decay and emit photons. Mercury arc lamps produce light across the full spectrum of ultraviolet light (from 100 nanometres [nm] to 1800nm). In addition to UV-A rays, this includes harmful UV-B and UV-C radiation that is hazardous to workers' eyes and skin.

"Using traditional UV lamps to cure inks on heat-sensitive substrates can result in deformation"

Mercury lamps run very hot, which can cause heat-sensitive printed materials to warp and wrinkle. Plus, mercury UV curing systems generate ozone that must be vented away from the work area. Using LEDs to cure UV inks doesn't generate ozone – nor does it transfer a lot of heat to the printed surface.

UV LED lamps are solid-state semiconductor devices. They produce light by generating a voltage to join positive holes with negative electrons, emitting energy in the form of photons. The light is focused within a narrow spectrum of ultraviolet wavelengths. Focusing specifically on LED technology, Phoseon LED curing units produce light only within the UV-A range, with wavelengths of 365nm, 385nm, 395nm, or 405nm.

Screen printing on bottles

Phoseon's FireJet ONE Air-Cooled UV LED curing system

Unlike mercury lamps that need time to warm up and typically run all day, LEDs provide energy instantly and can be switched on and off as needed. Print shop employees can turn off the LEDs every time they take a 15-minute break; some units are configured so the LEDs turn off between prints, providing further efficiency. LED curing units are expected to operate for more than 20,000 hours compared to less than 2000 hours for a mercury arc lamp.

UV-LED curing systems are offered either in air-cooled or water-cooled packages to ensure that the LEDs operate at a consistent junction temperature (the highest operating temperature of the semiconductor) during production and withstand harsh production environments.

UV LED INKS

For UV LED curing to be successful, you need inks that are formulated to cure within the high UV-A wavelengths produced by the LED lamp. UV LED screen inks include photoinitiators that absorb the specified UV-A wavelengths needed to ensure a full cure at the desired speed.

Today, companies offer UV LED inks for specific applications, including bottle decorating, container printing, durable decals, membrane switches, and indoor and outdoor point-of-purchase graphics. Some UV LED screen inks are 'dual-cure' formulations that also work with traditional mercury vapour curing systems.

Each new ink formulation must provide the desired curing performance at the speed of production and must also meet the adhesion and durability requirements of specific applications.

ARE LEDS SUSTAINABLE?

- No mercury! Mercury ban in manufacturing processes is growing globally.
- No greenhouse gases or ozone produced or requiring evacuation from facility.
- Significantly reduced energy usage versus mercury UV and high-energy IR dryers.

ENERGY SAVINGS

With traditional UV curing processes, the tremendous heat associated with mercury UV lamps requires a significant amount of electricity to operate. By replacing the mercury UV LED lamps with UV LED curing systems, Phoseon customers have experienced energy savings of up to 85%. Phoseon UV LED technologies provide energy savings of between 75 and 85% compared to prior drying systems. With the Phoseon lamps, there is no need for fume extraction units to remove the gases generated by mercury vapour UV lamps.

POLLUTION PREVENTION

In addition to the environmental advantages previously mentioned, UV LED lamps offer better than 50% lower CO_2 emissions. There is no need for fume extraction units to remove harmful gases and converters can diversify their product lines and enter new markets without having to expand floor space or risk exposing employees to volatile organic compounds (VOCs) and harmful UV-C ozone.

By removing its mercury stations and upgrading them with 13 Phoseon FireJet LED lamps (FJ200), an industrial equipment company such as Indeco can reduce its output of CO_2 by over 67 tons annually. The company also benefits from not having to reintegrate into the building the 23.5 million cubic metres of air extracted every year to remove ozone and the heat produced by the mercury lamps.

"There is no need to risk exposing employees to volatile organic compounds and harmful UV-C ozone"

WASTE REDUCTION

Conventional mercury lamps have a very short lifetime and need to be replaced every 1000–1500 hours. LED curing lamps extend beyond 60,000 hours if maintained properly. Upgrading to UV LED technology eliminates these replacement costs, offering significant environmental benefits with the removal of mercury. According to Phoseon, its LED lamps have a proven lifetime of more than 60,000 hours (counting only the 'on' time as turning lamps on and off is instant).

Operating expenses for a press with typical mercury vapour curing units, which generate plenty of heat, cost around $34,000 a year (and the mercury bulbs used eventually end up in a landfill). However, the cost for the same press installed with UV LED curing units adds up to an energy efficient $658 [£478] per year, according to Empire Screen Printing – USA.

SUSTAINABLE CHOICE FOR UV CURING

Today, all the major brands are requiring their suppliers to deliver more sustainable printing practices. Phoseon customers have experienced energy savings up to 85% with the implementation of UV LED curing systems. With traditional UV curing processes, the heat associated with mercury UV lamps required a lot of electricity to operate. The mercury lamps produce ozone, which is dangerous to breathe, especially in a constricted space such as a print shop. Air exhaust systems are required to extract the toxic fumes from the presses. These exhaust systems can be eliminated with UV LED curing, making it a far more environmentally-friendly process. ■

Phoseon FireJet is a registered trademark of Phoseon Technology

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