Focusing the UV spectrum

Brazilian canmaker Companhia Metalgraphica Paulista has made huge cost savings by switching its UV curing systems to use LED lamps. Danielle Ingram reports

A widely-used technology for inkjet, flexo and offset printing, the adoption of ultra-violet (UV) curing systems using light-emitting diodes (LEDs) in metal decoration has been slower due to technical challenges posed by the substrate, despite the numerous environmental and financial benefits.

Its use has been growing in markets such as Europe and China, but its introduction in Brazil took a joint effort that involved UV specialist UVTronic, UV-LED lamp manufacturer Phoseon Technology and Germany-based speciality chemicals group Actega.

"In a market such as Brazil, where the energy crisis has been hindering the growth of companies, making existing production lines run more efficiently is a good way to expand capacity while saving on costs and having less of a negative impact on the environment," says UVTronic's chief executive Evandro de Cerqueira Martins.

A mechanical engineer, Martins co-founded UVTronic in 2005, focusing on UV and UV-LED curing, including maintenance and retrofitting services to the canmaking industry.

The company was chosen by Brazilian canmaker Companhia Metalgraphica Paulista (CMP) to help with a 'state-of-the-art' project: a pioneering metal decoration line equipped with a UV-LED curing system, which is said to be the first in South America to start up commercial production using the technology.

Established in 1924, at Andrelândia in Minas Gerais state, CMP supplies cans and pails for the cooking oil, food and chemicals industries. It currently operates two plants, one in the São Paulo state and another in the centre west region of the country, in Goiás state.

"The sustainability aspect of this innovation is directly aligned with our mission. We had been looking for a more environmentally-friendly solution for our curing system, so when we found UVTronic it was the perfect fit," says CMP's industrial director Juarez Castro.

The canmaker wanted to retrofit its Crabtree two-colour printing line with capacity for up to 3,500 sheets per hour, which is installed at the Cajamar plant in São Paulo. The conventional UV system used five cassettes containing one lamp head each and two 1.2m-wide reflective blades. Each cassette required its own energy converter as well as an exhaust system containing a fixing structure, exhaust and motor. Its sheet conveyor belt had to be replaced monthly as the dispersion of heat generated in the region of the UV cassettes dried it out.

South America's first metal decoration line equipped with a UV-LED curing system has been designed by UVTronic in a pioneering project commissioned by Brazilian canmaker Companhia Metalgraphica Paulista (CMP)

"We developed a tailor-made turnkey solution to enhance CMP's curing power for inks with minimal downtime and impact to its operations," says Martins. The equipment contains more than 2,500 light-emitting diodes, which generate 24W/sq cm of irradiance at a 395nm wavelength. The head has a total emission window of 1,200mm x 200mm, a linear guide for adjusting the distance between the conveyor belt and the UV-LED array, as well as a damper system for quick inspection. In addition to the head, the curing system includes a power panel, a control panel (HMI) and a cooling system.

After a number of tests, commercial production started up in April 2020. The decorated tinplate sheets are used to make general line cans in a range of sizes up to 18-litre pails.

"When we started the operation, we had the option of working with the two curing systems, UV-LED or conventional UV," Castro explains, while Martins adds that as the LED system is much more compact, UVTronic was able to accommodate it as part of a hybrid solution to help the customer feel more confident before fully switching to the new system.

Impressive savings

It didn't take long for CMP to be convinced that the new technology was fine-tuned enough to run on its own. The 90 per cent saving on energy costs and up to 97 per cent reduction in maintenance also played a big part in this decision.

To generate UV light, conventional mercury lamps are powered with high voltages and high currents. An arc flashes through the lamp, exciting its mercury gas, which then generates a broad spectrum of electromagnetic waves ranging from UV to infrared. More than 70 per cent of this spectrum is not used in the curing of inks, coatings and varnishes, explains Martins:

"This process involves high temperatures above 600 deg C and

generates ozone as a by-product, which is a very reactive and harmful gas. To prevent the lamps from deforming and to eliminate the ozone generated, it is necessary to use powerful exhaust blowers.

"In other words, at all stages of transforming electrical energy into UV rays, conventional UV lamps present a series of losses that result in high energy consumption when compared to UV-LED lamps."

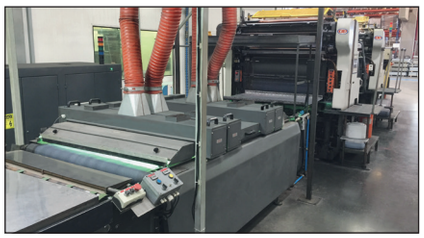
UV-LED lamps are more efficient because radiation is emitted exclusively in the ultraviolet range, he adds: "All the light generated is used in the curing process and it is not necessary to use high-voltage ballasts and exhaust blowers."

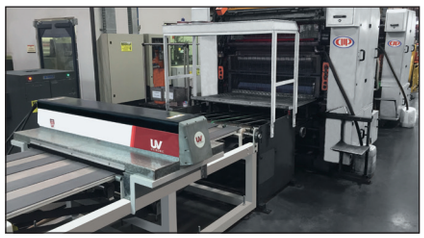
Martins explains that in addition to the energy savings, the UV-LED equipment also has a much longer lifespan when compared to a conventional UV curing system: "A standard UV lamp lasts for an average of 1,000 to 3,000 hours, while the LED system has an estimated lifespan of 100,000 hours. The equipment installed at CMP has been running for two years and we are far away from reaching its limit."

He adds that the lifespan of each LED lamp compares to around 80 standard UV lamps. "This reduction in machine stoppages for changing lamps means less downtime, and in a plant running 24/7 every half an hour counts."

Juarez Castro explained how this has affected CMP: "The process of changing the UV lamps and carrying out all necessary maintenance on the conventional UV curing system takes four hours. With the new equipment, we have eliminated the need to change around 400 UV lamps, which has a great impact on our productivity and also the environment."

Another added benefit is the more compact footprint of the system: "The standard UV system requires a huge converter and ventilation system, as well as light reflectors that end up losing power due to the heat. The LED system is much simpler, canmakers can use standard power supplies and the LED lights have a lifespan of 25 years."





The more compact UV-LED curing system has allowed CPM to save 90 per cent on energy costs and reduce maintenance by 97 per cent

Both CMP and UVTronic agree that one of the project's biggest challenges was the formulation of the inks. "At the beginning, the inks were drying too fast and had to be removed really quickly from the rollers; then it was changed but was taking too long to dry. Actega really had to work on adapting it to the different curing process, which is performed with the lamps closer to the substrate. From our point of view, it was paramount to maintain the same performance and quality," says CMP's lithography manager Daniel Rocha.

According to Actega's R&D manager Claudio Kristeller, the use of LED technology is common in paper and plastics materials but with tinplate being a completely different substrate, which also requires the use of an overvarnish, the company had to carefully develop and test the right formulation to offer the proper cure with enough adhesion.

"It required a very refined selection of raw materials because unlike standard UV lamps, that have a wide spectrum of light emission, LED lamps have a targeted wave-length," says Kristeller. "This imposes an interesting challenge to us as a manufacturer because fewer options of raw materials are available."

With such favourable results, CMP plans to upgrade its other presses to maximise the savings and positive environmental impact, says Juarez Castro: "All our initiatives and innovations are developed focusing on a minimal if not neutral environmental impact. Our headquarters in São Paulo was designed to make the most efficient use of natural resources, such as natural lighting and ventilation, reuse water and thermal insulation. Our manufacturing area was also designed so that there would be no risk of contamination of solid waste in case of incidents."

Considering that the average power consumption of a house in Brazil is 152 kWh per month, the savings generated by the project implemented at CMP is enough to power 100 houses. According to data from the Brazilian Ministry of Science, Technology and Innovation, the project will also help the canmaker cut down its annual carbon dioxide emissions by 18 tonnes.

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