

TAKING THE CURE

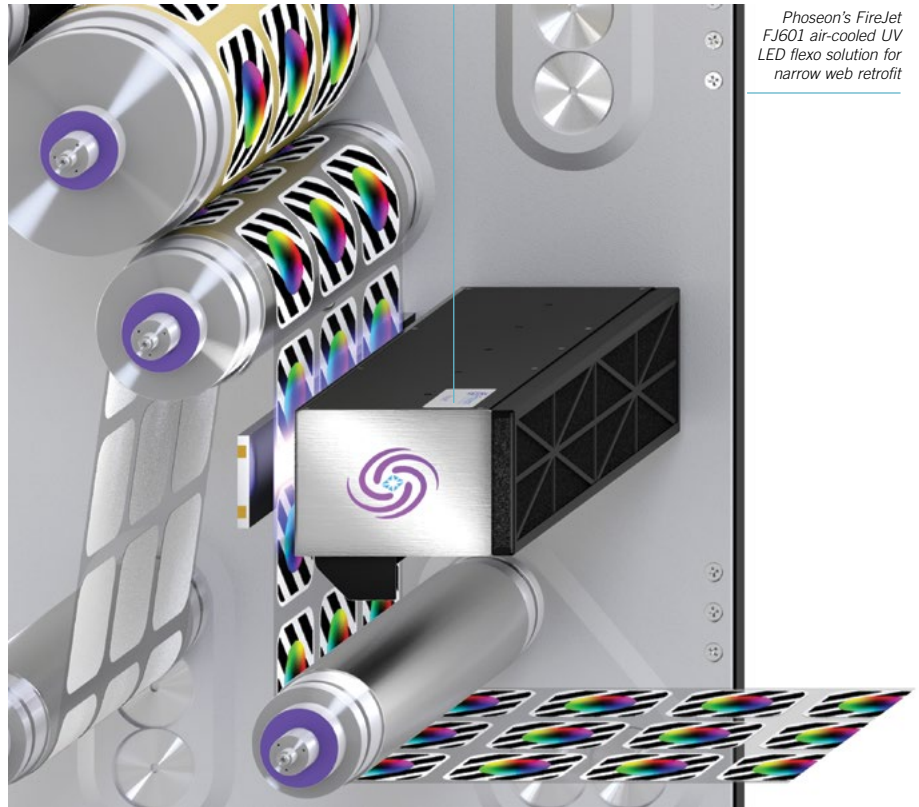
Jennifer Heathcote examines the growing role of UV LED curing in food-safe printing

From the perspective of food packaging, food safety means that the constructions, inks, coatings, adhesives and other materials used to decorate and convert the final barrier assembly are safe for consumption. All the respective manufacturing and material handling processes employed must not compromise the integrity of the packaged food item such that as long as the food is processed and packaged correctly, it remains safe for consumption over the intended product shelf-life.

UV LED FOR FOOD SAFETY

Ultimately, it is up to the converter and food packager to ensure that the materials and processes used for each food packaging job are in compliance with established regulatory guidelines. Advancements in UV LED curing include greater UV output, more efficient conversion of electricity to UV, longer system life, and a greater and more powerful range of products designed with air-cooling. Regardless of the curing device (UV LED or otherwise), it is up to the converter to ultimately ensure that the formulations are properly cured.

UV LED has the advantage over conventional mercury systems in that it offers repeatable and consistent output across each production shift of each day throughout the year. Since degradation in UV LED output occurs slowly, UV LED curing provides superior process control and confidence that the system is continuously delivering the same UV energy over time to properly cure the formulations. Food grade inks must be formulated with industry approved food grade



Phoseon's FireJet FJ601 air-cooled UV LED flexo solution for narrow web retrofit

ingredients. In production, the inks must be exposed to sufficient UV output (wavelength, irradiance, and energy density) in order to properly cross-link the components and provide acceptable adhesion and surface cure. This minimises the level of uncured materials that can migrate through the barrier constructions and reach the food.

THE CURING PROCESS

UV curing is a photopolymerisation process that uses UV energy to change a mixture of non-crosslinked solids into a crosslinked solid. Upon absorption of the UV energy, photoinitiators produce free radicals that initiate cross-linking with monomers and oligomers in a reaction that cures or solidifies

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the ink, coating, or adhesive into a plastic. The process of curing, or photopolymerisation, is the same for both general purpose and food grade inks; however, food grade formulations have greater restrictions on the ingredients that can be used as well as the levels of non-cured residuals that can be present following cure. This means that food grade formulations require additional and more frequent quality checks and inspections. Food grade formulations also tend to use ingredients with larger molecules that are less likely to migrate through the construction walls.

Converters should work with industry suppliers to first ensure that the UV LED system is matched to the needs of the press, the intended formulations, and the constructions. They should understand what quality checks should be implemented and ensure that formulations and constructions are converted before the end of their specified life. Finally, periodically inspect the UV LED system to confirm that it is indeed functioning properly and delivering the specified energy. There are numerous variables in the converting process. Defining and establishing the process window and then operating such that the press is run within that window will help ensure food safe packaging is produced.

COMMON MISTAKES

It is important that packaging converters properly maintain and regularly clean all their equipment with approved food safe materials. Problems occur when converters use formulations or other materials not approved for food packaging or when they have not confirmed that the UV system is properly matched to the formulations and products being produced. Because UV LED curing is relatively new, the market doesn't yet understand the differences in the commercial offerings. The performance of UV LED

systems from various suppliers can vary drastically depending on the design and the integrity of the assembly. Inferior UV LED curing systems are going to struggle to provide sufficient cure particularly at faster press speeds and often exhibit shorter life spans compared to better engineered systems.

FOOD SAFETY REGULATION

Food safety regulation and policies vary across regulatory bodies, and converters are often left to figure out implementation and compliance on their own. With current regulatory policy, it is difficult outside of using approved materials to know whether a product is actually compliant. Regulatory bodies tell the industry what is expected or what cannot be used, but no one is providing the converters with guidelines on implementation, cure, and go-no go quality inspections.

Formulators do a great job making sure that food safe formulations are only made with approved ingredients; however, the industry hasn't done a sufficient job of educating converters on how to implement process control and ensure the integrity of the final packaging.

Extraction testing using established global laboratories is commonly used by formulators and converters; but, these tests can be expensive and time consuming and are only

indicative of the compliance of the samples sent in for evaluation. The industry must work together to help converters understand what is required of them to be compliant with regulatory policy. Phoseon is also working closely with associations and UV LED formulators and raw material suppliers in an effort to educate the market on the nuances of UV energy delivered by LED sources and how it differs in comparison to that from conventional mercury lamps. As the formulators become more knowledgeable in the mechanics of UV LED output, new more efficient formulations are subsequently developed.

In addition, we become more confident in what the UV LED sources need to deliver across the varying print methods and press configurations. Greater industry collaboration results in better matched solutions that will ultimately drive food safe UV cured packaging. ■

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