As ink companies continue to develop formulations to optimise both UV LED curing and specific applications, users can expand the applications they offer to customers

Advancements in UV LED inks

UV curing is a photopolymerisation process that uses UV energy to change a liquid to a solid. Upon absorption of the UV energy, the photoinitiator (PI) produces free radicals, which initiate cross-linking with binders (monomers and oligomers) in a polymerisation reaction to cure or solidify the ink.

A photoinitiator is any chemical compound that decomposes into free radicals when exposed to light. These special additives ensure that an ink or varnish film is fully cured within a short time on exposure to light. Photoinitiators need light or high energy UV radiation, in order to trigger the polymerisation process.

INKS FORMULATED FOR UV LED
Ink formulation for UV LED technology has evolved significantly and, today, there are a growing number of suppliers developing inks that work well with UV LED light sources. One of the key ingredients in the chemical formulation is a photoinitiator that reacts to the narrow wavelength spectrum UV LED energy.

With the continued widespread acceptance of UV LED systems, availability of suitable base materials continues to grow. The driving factors in advancement of chemistry of raw materials are increased capability and cost effectiveness of commercially available UV LED light sources. New resins, monomers, oligomers and photoinitiators are continuously under development. Not only inks but also coatings and adhesives are now widely available that are either specially formulated for LED or work with both LED and traditional mercury sources.

As the technology has become more powerful and more compatible inks are available, this has resulted in substantial advanced capabilities for UV printing. Material suppliers have responded to the demand and challenge from the printing world to formulate raw materials that absorb energy corresponding to the wavelength of UV LED light sources.

Users report that UV LED curing light sources with formulated UV LED inks produce better cures and better adhesion on a wide range of materials, including recycled materials. They can also achieve higher speeds with black and white inks. Tough opaque whites and dense blacks are much easier to cure. UV metallic range inks are stable and print well. Inks do not cure prematurely when exposed to overhead lighting.

AVAILABLE INKS
Today, virtually all large ink suppliers offer products compatible with UV LED light sources. UV LED inks are available for digital, screen, flexo and offset printing applications. Dozens of companies offer UV LED compatible inks, coatings and raw materials, including: AcromaPro, Agfa, Allnex, BASF, Chimigraf, Collins Inkjet, Deco-Chem, Flint, ImTech, Ink Mill, INK, Kuei, Lamberti, Makieur, Marabu, Nazdar, Paragon Inks, Pelikan, Rojo, Sherwin-Williams, Siegwerk, Sunjet, Triton, Wilko and many more.

Here are some examples:
- Flint Group offers the EcoCure eco-friendly, high-performance inks for flexographic and rotary screen printing that are also backwards compatible with traditional UV.
- Agfa's Agora ink systems are free of solvents and VOCs and can be used for industrial decorative printing.
- Nazdar has developed a wide range of inks for use with UV LED curing technology for digital, screen and narrow web printers.
- Paragon Inks in the UK has released an ultra-low migration (ULM) LED range.
- The German ink-maker Rojo offers screen-printing inks that are free from toxic solvents and comply with a
European directive for toy safety.

Marabu offers Ultrapack LEDC series for rotary or flatbed screen printing.

DECORATIVE PRINTING

UV LED inks are being utilised for decorative bottle printing on glass containers for spirits, health and beauty, wine, cider, beer, bottled water, soft drinks, food and the promotional glassware industry. This decorating process utilises UV LED light sources for curing inks on glass containers to improve the quality of print.

Decorative printing processes allow for ultra-high gloss, matte and holographic effects. Cast and cure is a fast-growing technology that creates an holographic-style decorative finish on a variety of substrates for sheet-fed and web applications. Cold foil is the application of metallic foil, in line, at high speed in an infinite spectrum of colours.

PACKAGE PRINTING

UV LED curing has a broad usage across digital inkjet printing, adhesives and coatings. As it moves further into the more traditional printing processes of flexographic and screen printing, the UV LED ecosystem is creating low-migration processes that will enable food packaging to become the next major market to realise UV LED curing benefits. The next step on the horizon is UV LED inks for low migration packaging.

Low migration for package printing is a hot topic in Europe. With low migration regulations and continuing RoHS regulatory challenges for traditional mercury bulbs looming in 2016, it is imperative for the entire UV LED ecosystem to work together, ensuring a smooth stable transition to a low-migration future. The growth will be driven by regulations of the printers and brand users – and consumers.

WHAT IS LOW MIGRATION?

"The term 'low migration' packaging is commonly used to designate materials used in the packaging structure, whose components will not migrate or move, from the packaging into the product." (Sun Chemical http://www.sunchemical.com/low-migration-inks-and-coatings/) It is very important to point out that low migration is not about an ink but about a process. The process includes the following: press, substrates, ink, curing, rollers/screens (in case of flexography/screen respectively), ink film thickness, colour print order and max ink deposition.

"To qualify as low migration packaging, compounds contained in the packaging structure, including printing inks, coatings and adhesives, must not have any effect on the appearance, flavour, odour, taste or any negative effect on the safety of the product contained within the packaging," Sun Chemical added.

There are two types of migration. First is diffusion migration, where small molecules can easily penetrate into and diffuse across packaging material layers. This can occur even if the printed material has not yet been converted into a food package and filled with food or later on when the printed package is filled with food and the food starts to 'extract' the migrants from the packaging material.

The second is set-off migration, where migrants can migrate from one layer to another, such as a surface printed layer to the non-printed food-contact surface, which is later brought into contact with food. If these are in direct or close contact like in a reel or a stack after printing, set-off migration can occur due to the pressure existing in the reel or stack. During the packaging process, the material must be cured sufficiently before it is rolled into a web or stacked during a screen process, otherwise it might transfer to the non-printed side of a label, which would then come in contact with the food article.

UV LED technology benefits, in conjunction with low migration printing processes, make for an ideal application. LED offers excellent through cure due to the narrow LED wavelength (UV). It offers more than 20,000hr of operation, with only minimal power drop over time. This process stability is very important to product manufacturers, as they can ensure their products are cured consistently run after run, without having to worry about bulb degradation. Additionally, UV LED technology provides a uniform output across the print width, which again ensures fully cured product.

CONCLUSION

Over the past few years, a growing number of ink companies have been working hand-in-hand with printing equipment developers to develop ink formulations that are optimised for both UV LED curing and the specific application. Users of UV LED curing and ink technology can expand the range of applications they can offer, run equipment at higher speeds, achieve new levels of print quality, use substantially less energy, reduce scrap, reduce VOC emissions in the workplace and print on lower cost or more environmentally friendly materials.