Going deep into coatings and curing technology

Chemistry and intensity are two of the main considerations for those developing coatings and varnishes for the future, as well as those producing the equipment needed to dry and cure them. *David Pittman* reports

As technology advances, so the application range for digitally printed packaging broadens. Whether serving a practical, protective purpose or providing visual enhancement, coatings and varnishes are a vital part of the production process for labels and packaging. For those producing these consumables, this provides some specific challenges.

According to Paul Edwards, vice president of the digital division at INX International Ink, 'The challenges to creating a digital coating or primer depend upon the application and printing technology used.'

The XP Quatro platform has been developed by AMS Spectral UV to provide more than twice the total energy while only adding 25mm in height and width in the machine direction

As an example, he identifies how a coating or primer used underneath an image must modify the characteristics of the substrate in order to provide the required adhesion, absorption and print quality. The coating must be formulated to adhere well to the substrate and the inks themselves, while allowing a certain level of drop spread to provide good print definition and smooth flat fields. For a varnish the challenge might be to create a very chemically resistant surface while maintaining good flexibility for forming.'

Phil Jackman, global digital product manager at Sun Chemical, affirms the importance of coatings working well not just with the substrate, but with the layers of ink and primer underneath it. 'You can end up with a fairly complex structure made up of multiple layers of primers, inks, coatings, varnishes and adhesives and it all has to work together to deliver the end product needs,' he comments.

Chemistry in action

Sun Chemical's SunEvo range features a range of varnishes specifically formulated for adhesion to HP Indigo ElectroInks and to achieve high levels of mechanical durability on HP Indigo printed labels. Available as gloss and matte finishes, these varnishes promote cross-linking with the HP Indigo ElectroInk and the primer layer to deliver improved physical properties, bonding all layers together for 'maximum' durability.

INX has a range of UV digital varnishes for different printer and application types in its portfolio. Going forward, the company is expecting more demand for UV and water-based primer technologies to change the characteristics of the substrate, as well as further varnishes to modify the surface of the printed image.

All must address growing demand for more sustainable printing options. Siegwerk is one of those rising to this challenge and has been developing its portfolio accordingly. From the CirKit ClearPrime printable delamination and deinking primers to barrier coatings that are recyclable and feature 100% natural content, the company is, 'fully committed to enabling sustainability across the value chain,' says Alina Marm, Siegwerk's global head of sustainability and circular economy.

The company is also committed to updating its manufacturing footprint to ensure that is as efficient and sustainable as possible. The recently completed modernisation of its Centre of Excellence in Annemasse, France is an example of this. This site combines R&D, production and testing capacities under one roof. With a production capacity of more than 25,000 tonnes a year, it also accounts for 10% of the group's annual output. It is regarded as Siegwerk's leading location in Europe for the development and production of water-based and inkjet solutions. Having invested millions of Euros over the last decade to build up a 'sustainable, efficient and competitive' Centre of Excellence for the region, Christopher van Laack, vice president responsible for Siegwerk's EMEA paper and board and liquid food packaging business units, says, 'Today, Annemasse already belongs to the state-of-the-art industrial printing facilities in Europe and we will continue making every effort to stay at the forefront going forward.'

In relation to process, Mr Edwards sees digital technologies as providing an opportunity to place a given amount of coating, in exactly the correct place needed, using a non-contact printing process in the case of inkjet. He says brand owners and printers can take advantage of these characteristics in both a fully digital printing system and on a hybrid system.

'Digital coatings and varnishes require special characteristics, mostly based on printing technology. For example, usually the viscosity is very low compared to analogue printing, say 10cp at 40 degrees C and the printhead requires a specific range of static and dynamic surface tension characteristics. There are also significant particle size limitations for reliable jetting performance, which are much lower than in analogue technologies. However, more recently, developments in digital printing technology have allowed for much higher viscosities and particle sizes.'

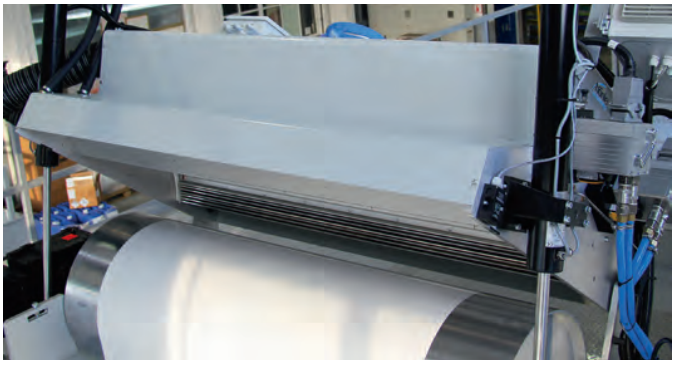
Mr Jackman says that, 'When it comes to digital inkjet coatings in particular, getting them to replicate or surpass the properties of an analogue coating is hugely challenging given a digital inkjet coating has to be jetted from a printhead rather than simply applied via a roller, cylinder or plate. This poses significant challenges when it comes to the ink chemistry, as the coating needs to be lower viscosity and utilise components of lower molecular weight than would typically be used in analogue coatings to achieve the same end result. It must reach a certain viscosity and surface tension to provide good drop formation when jetting and therefore, by their very nature, these materials aren't typically as robust in terms of their final properties compared to conventionally applied coating. This is where experienced inkjet technologists can optimise the performance of digital coatings.'

Lay down, stay down

Those involved in the drying and curing of such chemistries are having to advance their technologies in response to similar drivers.

As noted by Kevin Joesel, Baldwin Technology's industrial sales executive for the Americas for its AMS Spectral UV product line, 'Digital chemistries as defined as inkjet or toner typically have slower process speeds and are often very close to the lamp aperture where UV LEDs shine, due to much lower heat (infrared and visible) exposure to the substrate. In many cases UV LED is used due to its low energy consumption but limits the formulators in the raw materials they can use. Conventional chemistries are broader in the types of inks used and the speed of the process, and may require the heat and broad output spectrum to achieve the performance and productivity requirements.'

He goes on, 'Printing and converting are somewhat different in that the technology is placed on/in presses and inks are being cured, which can be different based on the application technique resulting in slightly different curing specifications. With printing, the physical specification is known, whilst when converting the size constraint is more open as there are a wide variety of coating application technologies, high variabilities in thickness/weight, highly variable performance requirements. This results in a wide variety of UV curing specifications.'



Dr Hönle has developed curing systems featuring a UV-inert process chamber situated above a chiller drum, which results in optimised temperature management of webs and reduces nitrogen consumption by around 10%

UV specialist Dr Hönle offers a range of curing systems, including UV options featuring specially developed reflector geometry that can deliver 50% more higher peak intensity than comparable units. Optional barriers allow these UV modules – pureUV and LightGuide pureUV – to absorb most of the infrared radiation so that, even on temperature-sensitive substrates, inks and varnishes can be cured 'quickly and efficiently', the company claims.

LightGuide pureUV is designed to be directly plugged into the printing or converting machine, whereas pureUV has a compact housing and can be flexibly installed in the sheet-run of a machine. LightGuide modules are also used in UV inert chambers, developed and produced by the company. The installation of a UV-inert process chamber above a chiller drum results in optimised temperature management of webs and reduces nitrogen consumption by around 10%.

Its LED Powerline family of UV LED curing units feature focused optics that generate a high intensity and optimise the systems' UV LED output for greater distances to the substrate. The modular design of the LED Powerline permits the switch-off of single segments to adapt to different substrate widths.

The air-cooled jetCURE LED is available with different LED assemblies and wavelengths up to a maximum intensity of 18mW/sqcm. Due to this flexibility, the system configuration can be matched to the curing requirements of the application.

AMS Spectral UV offers products with high dose and widths from 250mm to 2000mm, as well as custom options and multiple UV LED platforms. Mr Joesel examples the company's XP platform, which has been developed for retrofitting onto printing presses so has a form factor that that fits such installations. 'In converting, the curing station/location is independent of the press allowing a larger form factor, so the XP Quatro platform was developed to provide more than twice the total energy while only adding 25mm in height and width in the machine direction,' he comments. •