

FLEXING ITS POWER

There are growing opportunities for water-based inkjet to be used in the flexible packaging sector. Dr. Thomas Lehnen looks at the challenges involved



Dr. Thomas Lehnen is Head of Water-Based Inkjet Business at Siegwirk

Flexible packaging could become one of the largest volume applications for water-based piezo inkjet printing in the future. Market forces such as shorter job lengths, reduced working capital and shorter time to market are making companies look at new ways of production. In addition, inkjet allows converters and brand owners to differentiate via individualisation, serialisation (e.g. for track & trace), point of sale marketing and leaner total production processes.

On the other hand, flexible packaging remains an extremely demanding market



A combination of compliance, sustainability and performance is needed to enable circular economy of packaging with water-based inkjet

where the role of the ink film extends far beyond decoration. The choice of print process is not a defining factor for the consumer and inkjet needs to be on par with gravure and flexography when it comes to print quality, ink film resistance and regulatory compliance. The flexible packaging industry is on the verge of the circular economy revolution, adding new requirements to the list.

"The flexible packaging industry is on the verge of the circular economy revolution"

Furthermore, piezo inkjet inks also need to comply with all requirements coming from the digital printing process itself. Forming HD images from aqueous particle dispersions using high-precision microelectronics is anything but trivial. The development of inkjet inks with carefully designed jetting, wetting, drying and film forming behaviour is technically and practically challenging.

To understand the opportunities and challenges of water-based inkjet in packaging, it is useful to consider the different demands in more detail and to point out differences between digital and analogue printing.

DEMANDS DURING PRINTING

Ink compatibility: with all relevant parts of the print system. Sounds easy? Far from it! Digital printing machines are way more

complex than their analogue counterparts. Polymers in the print equipment might swell, deform or embrittle when interacting with the ink. Metal parts might corrode. The growing number of different printheads on the market make the ink compatibility question even more sensitive.

Print speed and ink drying: to keep up with industrial standards, inkjet needs to achieve three-digit numbers in terms of

m/min. Billions of drops must be jetted and placed accurately every second. Individual nozzles may fire up to 10 drops while the first drop is still in flight. To make this possible, common printheads operate at viscosities below 10mPas and picolitre drop volumes. Fast drying of such highly fluidic inks in a temperature and humidity sensitive environment is challenging, especially when it needs to be highly regioselective. Ink must not dry in/on the printheads to ensure a user friendly operation but still needs to dry immediately on the substrate.

DEMANDS DURING PACKAGING PRODUCTION

Print quality: is a must-have for flexible packaging, and inkjet is not regarded as highly as flexography or gravure. Of course, ensuring high image resolution, adequate



Siegwerk assures best in class product safety and compliance by following stringent raw material approval processes and supporting migration studies

drop spread, controlled inter-colour bleeding and colour strength is not easy with a water-based media on non-porous materials such as those typically used in flexible packaging. As with any printing technology, the achievable colour gamut is closely related to the number of colours printed; e.g. hexachrome can do more than CMYK, but additional print bars inflate equipment cost.

“Water-based inkjet is the perfect tool for lean processes and short runs”

Ink film adhesion, resistance and lamination: can be adjusted by tailoring the ink recipe within the parameters of ink viscosity, fluid conductivity and particle size defined by the inkjet technology.

For both inkjet ink film fastness and print appearance, analogue enablers like primers and over-print varnishes (OPV) play often a major role in closing performance gaps, but also by limiting the number of different inkjet inksets needed to cover a diverse range of applications within the flexible packaging industry.

REGULATORY COMPLIANCE AND CIRCULAR ECONOMY IMPACT

Flexible packaging is traditionally used to pack food, encompassing a variety of different food products packed in many different packaging structures. End customers' safety expectations mean that inkjet-printed materials will not be treated differently from analogue-printed structures – regulatory compliance will be addressed with the same rigour regardless of the ink type or the print technology. To ensure best-in-class product safety and compliance, diligent raw material approval processes, modelling of the migration risk, and real case migration study need to be carried out in association with a thorough understanding of the packaging manufacturing processes.

Circular economy: 'Design for less waste' and 'design for recycling' are the new demands on everyone's list. Here, water-based inkjet offers some real advantages. Suited to print variable data without the need of repetitive elements, and to print on-demand without extensive set-up times and process waste,

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inkjet is the perfect tool for lean processes and short runs. Decentralised production, late-stage customisation and direct-to-object printing open up new opportunities for production and design of packaging.

The list of demands seems extraordinarily long... and indeed the overall challenge is significant. Still, inkjet has proven its capacity to adapt to many markets and cope with very diverse challenges. Success in flexible packaging will come by combining the right expertise in both equipment and fluids.

Ink specialist Siegwirk brings together a unique combination of application know-how in flexible packaging and inkjet ink formulation excellence. The company leverages a large industry network composed of printhead manufacturers, inkjet integrators, drying solution providers and hardware equipment suppliers. ■

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