ESMA
Driving Print Excellence
May-June 2016

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Profitable and consistent print production workflow

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Colour management for inkjet printing on hollow articles

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EXPERTS
IN INDUSTRIAL PRINTING

An exclusive ESMA publication for drupa 2016

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PRINT IN PRODUCTION: WHEN PRINTING MEETS INDUSTRIAL APPLICATIONS

by Peter Buttiens, CEO, ESMA
Maciej Bochajczuk, MarCom, ESMA

For many years drupa has been the place for commercial print but since the last exhibition in 2012 this sector has suffered a drastic market decline. Several major players anticipated by switching to digital technology and entering sectors such as packaging and labels. ESMA members took the industrial path. We call it "print in production" as printing has truly become a production method for fluid deposition. It can serve decorative or functional purposes but the potential is similar if not greater than that of 3D printing.

IN-HOUSE KNOWLEDGE HUB

ESMA was founded in 1990 as the European association for equipment manufacturers in screen and digital printing. Over the years, our focus spread to all industrial, functional and speciality developments in fields such as interior decoration, textiles, printed electronics, glass and plastics. ESMA's mission to stimulate disruptive technologies which go far beyond traditional graphic and signage markets, have been realised on multiple conferences: GlassPrint, Advanced Functional & Industrial Printing, Printed Interior Decoration, Direct Container Print and The Inkjet Conference – the latter launched in 2014 to reflect the increasing driving force of digital printing. All of them bring together industry and academia, and as such deliver advanced technical knowledge in order to endorse the leading market position of the European printing community.

Involved in international research projects for the emerging niche markets (CLIP, POLEOT, SensorTEX, digital fashion printing at EURATEX) and with over 70 members at our side, ESMA has become the knowledge hub of the industry. The association's manufacturer members represent machinery, equipment, software and consumables sectors. Our technology partners are consultants, printers, inventors and developers. Their joint experience and our track record in promoting printing for manufacturing processes during dozens of conferences and masterclasses, give us both confidence and responsibility to support and educate all those who are ready to take their printing business to the next, industrial level.

Organised by ESMA, The Inkjet Conference attracted 400 participants in October 2015

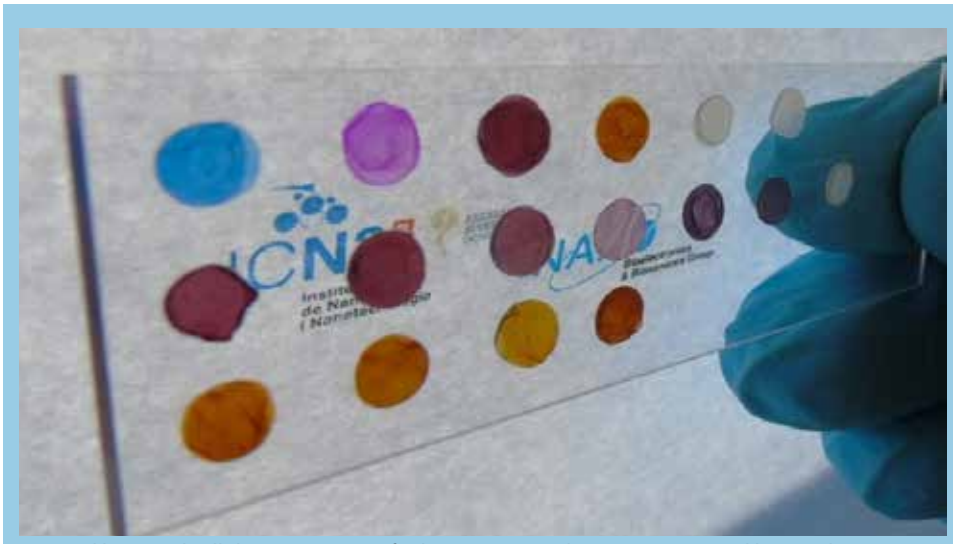
PULSE OF THE INDUSTRY

When observing the tendency for print companies to specialise within a certain field and watching industrial printing gaining grounds also from the technical innovations perspective, we took the pulse of the leading technology providers and surveyed ESMA members at the beginning of 2016. When looking back on the market highlights from their business' point of view, many would point to the implementation of combined or hybrid printing processes. More than ever machines include digital printing units and direct-to-shape decoration on glass and plastic packaging becomes a viable alternative. The confidence in inkjet technology grows among system integrators, converters, packaging companies, and – last but definitely not least – brand owners. On the other hand, advancements in mesh, chemistry and the introduction of new drying techniques allow the screen technology to uphold their dominant position in printed electronics, automotive or textiles. Will the progress in nano-technology and strong adoption of new decoration inks sway that hierarchy? Marcus Borghoff from Europa-Siebdruckmaschinen-Centrum puts it as follows "The breakthrough in nano-inks gives a new punch to manufacturers who supply and develop products with wood, glass, real and artificial leather, as well as thermoformed plastics and many other applications that still need to be discovered."

When asked about the key drivers for integrating print in the manufacturing processes, our respondents mentioned factors both from the business and technology perspective. "Key drivers for future growth areas are the electronic and touch panel industries where

features such as chemical resistance and opacity are instrumental. The ability to selectively apply ink, coating or functional material makes print ideal for processes beyond decoration to functional", said Friedrich Goldner from Marabu. Focusing on the digital side, Roland Biemans from LMNS stated that "stability and price are key factors for inkjet printing. Stability translates into reliability that is needed for longer run manufacturing where the production process needs consistent and reliable output. Price is a factor for disruptive or replacing technologies when it comes down to comparing with traditional systems. From the technological point of view, new printheads and new ink formulations coupled to speed and reliability are key drivers." In the words of Agfa, it is "a combination of small incremental changes and fundamental technology innovations that will allow for more and more applications to benefit from industrial printing. Unlike other markets where new products are offered with new features, the industrial printing market is more driven by integration of new technologies and the cooperation between many parties (integrators)."

The list of products or market sectors which benefit the most from the possibilities unlocked by printing, is very long. ESMA members name here touch panels, ceramic decal, smart packaging and smart textiles, garments, plastic, glass and metal containers, labels, leather, wood and virtually all substrates used in decoration. So, is there anything left to await in excitement in 2016? Without doubt we can expect the further march of mass customisation techniques, accompanied by the improvement of sustainable and low migration inks. Dedicated high-speed and single-pass solutions will attempt to grow their share for textile and packaging applications. On drupa 2016 one will indeed get the chance to "touch the future" and investigate combined printing approaches that allow a full effect and functionality spectrum for decorative, 3C, bio-medical, pharmaceutical and automotive sectors. "Our industry will meet at drupa where solutions shown will range from complete prepress with chemistry-free printing plates, advanced software and printing systems, to a wide variety of fluids including inkjet inks, primers and coatings, both for conventional and for digital printing alternatives," sums up Agfa.



Printed bacterial cellulose nanopaper for biosensing applications, presented by Catalan Institute of Nanoscience and Nanotechnology at ESMA's AFIP conference in March 2016

TURNING INNOVATIONS INTO PROFITS

As technology moves ahead and matures, we cannot forget that it is not technology that the consumers buy. They buy features and benefits that technology enables: cost-savings, better business practices and optimised resource planning. The crucial question is therefore: How can the technology users turn a profit with machine, ink or software innovations? How will they use the innovative power of print?

To answer this question ESMA has appointed the Expert Team, a platform of consulting, advice and the first contact point for business- and technology-related issues. The initiative has a focus on offering both ESMA members and the industry as a whole access to expert knowledge, in line with our association's mission statement which includes "adoption and correct use of various specialist printing processes", as well as "developing higher technical standards for specialist printing processes". A team consisting of ESMA members and technology partners is now willing to share their expertise and meet the first printing advice seekers at drupa 2016.

Where do you go to find answers on print production today? Do you have a digital printing strategy? What is your biggest challenge in printing for the industrial sector? Or are you preparing to specialise in a functional application and you need assistance in entering new market areas? Introduced by this publication, the ESMA Expert Team will be in place to guide you through sector-specific printing requirements. Currently covering topics ranging from digital business transformation, textile printing, printed electronics, speciality ink developments to image inspection, colour management and workflow, our experts are not a closed group and still welcome new additions to the team. With the support of ESMA manufacturing members, the project can only grow and inspire more print companies branching out into the world of industrial applications.

We invite you to read the following five contributions and hopefully recognise the challenges faced by your printing business. We are then looking forward to address them during the expert sessions organised at ESMA Lounge in hall 3, pavilion B70.

Representatives of brands, container, machine and ink manufacturers during the live panel discussion at the first Direct Container Print conference in November 2015

MEET THE EXPERT TEAM

Meet our experts in printing technology and business innovation. They will handle the following topics during the expert sessions:

ROLAND BIEMANS. LMNS

(see pages 7-8)

- Opportunities and challenges in new business development
- From technology chain to value chain
- Digital textile printing

JOCHEN CHRISTIAENS. INKJET CONSULTING CHRISTIAENS

(see pages 15-16)

- How to turn applications from analogue towards inkjet printing; challenges and solutions
- Speciality chemistry development and testing
- RIP software and colour management solutions

FRANK EIRMBTER. SUN CHEMICAL

- Leverage knowledge of advanced material technologies in inks, printing and electronics
- Printed electronics, smart labels, antennae, electronic packaging and Internet of Things
- Technology and adaptation in flexo, screen and inkjet printing

STEVEN HARNIE. PRINTRIX

(see pages 19-20)

- Digital textile printing: Minimising turnaround time (production workflow from graphic design to finished product)
- Digital textile printing: Maximising product quality (colour accuracy, print quality and finishing)

OLIVER KAMMANN. K-FLOW

(see pages 17-18)

- Colour profiling on glass and plastic containers
- Colour management workflow for industrial printing
- Profiling technologies for industrial decoration

PHILIPP KLINGER. SOTFCON

- Development of inks needs a real test environment; How to design a lab-printers system
- Problems occurring when transforming industrial production from analogue printing to inkjet
- Digitalise you screen production – screen printing is still an excellent technique
- Colour management in industrial printing applications
- The roll of RIP software in industrial printing

STEVE KNIGHT. DIGITAL DIRECT TECHNOLOGIES

- How to select the appropriate core inkjet technologies and partners for the specific market application
- Ink, chemistry and system design consultancy
- Education and introduction to inkjet

LUCIEN MOONS. REBOOT MOMENTS

(see pages 9-10)

- How to use business innovation to grow your print business and leverage the internet opportunity
- How far along are you on your company digital transformation journey

45 ESMA MEMBERS AT DRUPA

As an associated partner for functional and industrial printing, ESMA, the European Specialist Printing Manufacturers Association, will showcase the expertise of their members in two pavilions at drupa 2016. With more than 550 sqm in total and filled with key market players, ESMA pavilions in hall 3 and 6 will offer a 360-degree view on print as part of the manufacturing process.

ESMA PAVILION IN HALL 3

The pavilion around the ESMA Lounge is dedicated strictly to functional and industrial printing and – next to the Expert Team – brings together the leading global suppliers in this sector:

- Anton Hurtz (B70-5)
- EPTA Inks (B70-3)
- ESC – Europa Siedruckmaschinen-Centrum (D70-1)
- FIMOR (B70-6)
- Global Inkjet Systems (B70-9)
- Imagico (B70-7)
- K-Flow (B70-2)
- Kissel+Wolf (B71-1)
- Lotus Holland (D70-2)
- Martinenghi (B70-8)
- PVF (B70-4)
- Saati (C72)
- Sefar (B71-2)
- SPS (A70)
- Technigraf (D70-3)
- Ulano (B71-3)

ESMA PAVILION IN HALL 6

As drupa's strategic partner for the PEPSO (Printed Electronics Products and Solutions) concept, ESMA will showcase innovations in printing through:

- Caddon (C02-3)
- ColorGATE (C02-5)
- Color Passport (C02-1)
- Intrinsiq Materials (C02-4)
- Print-Concept Roeber (C02-2)
- Teckwin (C02-7)

OTHER ESMA MEMBERS

- Agfa (hall 8a, B62-1, B62-5)
- Caldera (hall 6, C23)
- CST (hall 5, C03)
- Durst Phototechnik (hall 6, D40)
- EFI (hall 9, A40-1, A40-2)
- Fujifilm (hall 1, B19; hall 8b, A25-1, A25-3)
- Gallus Heidelberg (hall 1)
- Grünig-Interscreen (hall 3, C96)
- KBA Kammann (hall 16, C47-1, C47-2)
- Marabu (hall 3, A87)
- Mutoh (hall 9, C22)
- Natgraph (hall 3, A90)
- PrintabLED (hall 15, A13)
- Roland DG (hall 9, E04-1, E04-2)
- SignTronic (hall 3, C96)

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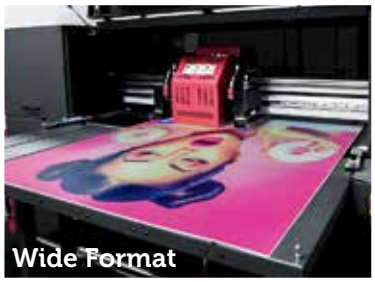

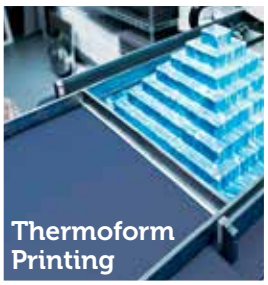

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CONNECTING THE DOTS – CHALLENGING THE COMPLEXITY IN PRINT PRODUCTION

by Roland Biemans, LMNS

New printhead technology, ink formulations and software solutions are paving the way to seriously benefit from improved quality and possibilities. However, dubious marketing spin and the drive to over-simplify configuration requirements and production limitations tend to overshadow sound advice and practical implementations. Moreover, many production processes are governed by speed of throughput with these rates being the principle criteria for running an efficient business. Manufacturers of machines are quick to promote these running speeds as a direct line to profit but, in truth, the numbers of square meters per hour which can be generated only represent one element of an overall cost-effective operation.

SPEED

Even though great progress in understanding has been made over the last few years, there is still a huge gap between what is expected and what is possible. From a practical point of view, production speed has to fit into a company's overall working operation where individual machines are in use for different parts of the process. This also takes into account logistics, manageability and, of course, the number of operators on the print shop floor. It is not only the maximum amount of printed media in an hour that counts, although many print shop owners and printer manufacturers alike focus on this single parameter; it is more what the total throughput as an end product comes to.

Speed of a machine's output does not necessarily lead to overall efficiency. The most important thing about running a print shop profitably is setting up the workflow properly. Although this may seem as an obvious thing to do, the numbers of companies missing out on making the most of their production is vast. In some cases, this is understandable because the print shop owner literally grew into the situation of having different types of equipment over time. His only solution was to invest in incompatible systems to get a specific job done. However, many businesses and their owners also just accepted the production setup, simply because there was not a trigger to optimise its facility and its workflow, and to generate greater efficiency.

With more companies focusing on digital printing, there is a growth in available new products, services and opportunities. The downside is the often-heard complaints about insufficient proper advice and lack of expertise. This criticism applies to manufacturers and suppliers, as well as to print service providers. As a result, many end-users are not provided with solutions they are looking for and print shops find that they need to make additional investments to hold up to the promises being made.

WASTE

Print shop owners who take a step back to look at their production facility may come to shocking insights when they discover that 20% of their output is thrown out because of production failure. A quick assessment shows that some machines or operators are standing still and idly waiting for another process to finish before they can run the next step of the production flow. Additionally, because of incompatible systems, considerable amounts of time are wasted on converting or changing media, rolls or processes.

Another common problem concerns the colour reproduction and matching across systems. An issue often mentioned is the inability to catch mistakes before they happen. Operators that have grown to accept a certain system or method might get stuck with what they are accustomed to, and never research new or better options which can lead to greater efficiency and improved workflow overall.

Logically, running different types of machinery will cause variations in output. Different inks produce a different colour gamut, and different media will have had different treatments. Different print processes feature different resolutions and ink droplet shapes and sizes. Some inherent differences cannot be circumvented but, in pursuing optimisation, it is certainly possible to greatly improve end results.

This poses an interesting question: is print speed still the most important factor when valuing the overall production process? The obvious answer is: workflow efficiency does not come from print speed alone.

Because of a tougher economy, greater competition and with the rise of converging markets, it is becoming increasingly apparent that an optimised workflow can be exactly the key element that keeps a company afloat. Better still, this efficiency can enable companies to grow their businesses with greatly improved margins.

IDEAL ENVIRONMENT

In an ideal world, a truly efficient and reliable workflow needs to be based on compatible elements which, together, provide seamless production in a harmonious environment. There would be no nasty surprises likely to spring up from any part of the processing

procedure, from file generation, colour management, printing and finishing.

Often, in a single print shop, many manufacturers and suppliers will have delivered equipment with their own methodology and their own ideas on how to approach a production flow. Where one supplier suggests optimising their specific machine in a certain way to get better results, this can result in adverse effects along the way with other processes. While one production method may work well, in another it may cause a lesser quality, or, worse, slow down overall production.

Accurate colour reproduction is more than measuring patches

Where one manufacturer's RIP software will be perfect to run a specific machine, in a combined environment of different printers it can cause operators to lose time or find themselves struggling with unwanted misprints. Likewise, where one supplier may claim it sells media fit for any purpose, this can actually result in worse output than would be possible had a better media from another supplier been used.

For the majority of inkjet technologies in use today, each element is independent from the next so that the printing machines and finishing stations are not related because they are manufactured by different specialists. Even where one manufacturer provides a bundle or combination, it is often based on equipment coming from different places. This means: slightly different machine width and different media handling; different approach to optimising speeds or developing interfaces and no relation between what happens at the beginning of the process and what can influence it at the end. It does not mean that any single component is bad in itself, but combined makes it less efficient.

Good workflow also involves generating efficient practices across all production areas. Many of these might appear to be based on common sense but this approach normally only becomes apparent if there is an awareness of all the processes involved in daily working, from start to finish.

CONCLUSION

The value of an efficient workflow is based on overall throughput, and not merely that of the printing machine speed – after all, its role is only one part of the entire process. System efficiency and ergonomics also play a vital part in the economics and logistics of running an effective production line. True compatibility between software, printing, post-processing and finishing ensures that an operation flows smoothly and economically. This type of setup, where each unit represents a sum of the total system, means that operators can add to the overall productivity by planning each job within given parameters, knowing that their workflow is tailored to the solutions being used and the people who are using them, and without unwanted or unexpected interference or disruption.

HOW ESMA AND LMNS CONNECT THE DOTS

It is not an easy task to filter the marketing stories from the realistic production figures. There is no global forum or online portal with product reviews and comparison sheets. Well-known manufacturers might not have the right product but produce convincing marketing "spin", while lesser known manufacturers could have the perfect product but do not have the right exposure. Furthermore, resellers may offer products from different suppliers that may or may not be entirely compatible.

ESMA is working with its members and technology partners to answer questions about the best practices in digital print production by combining the expertise of many involved. Part of its motto has always been to improve training and knowledge via technical articles and seminars and to stimulate worldwide exchange of technical information.

One example of how complexities in print production can be countered is the approach of ESMA technology partner LMNS, an expert initiative that combines the know-how of its network of specialists that have a track record in the areas of visual communication, sales and marketing, printer development, ink formulation, textile, packaging, software, colour management and many other disciplines related to traditional analogue screen printing, digital inkjet printing and print workflow processes.

Both serve the same industry with a similar attitude: connecting the dots in order to catch problems before one dot is printed.

MEET ROLAND BIEMANS AT ESMA LOUNGE (HALL 3. B70) DURING DRUPA

WHEN SHOULD YOU INNOVATE YOUR PRINT BUSINESS MODEL?

by Lucien Moons, Rebootmoments

What are the external circumstances that might suggest it is time to innovate your business model? They can be grouped into threats and opportunities.

EXTERNAL CIRCUMSTANCES: THREATS

First, there are two basic threats to the incumbent business that require the business model to be changed. Or, as Peter Drucker would say, times when "the theory of the business is no longer working."

One of those threats is the process of commoditisation. Generally speaking, industries go through a fairly predictable progression. The basis of competition moves from performance – making the better widget or print run – to reliability. It means making that widget more reliable, longer-lasting, and more durable.

When should you innovate your print business model?

It will lead to making multiple different widgets and making them more convenient and customised for individual tastes like print on demand. At the end it leads to commodity, when everyone is competing only on price and cost.

In the evolution of that lifecycle, business model innovation starts to play a role at the point when you get to customisation and convenience, and is fairly imperative as a way to escape commoditisation.

Let us look at business like the printing business that had to change due to external forces. A great example of the convenience play is Dell Computer which came into the personal computer market and said, "We are going to make a play for convenience and customisation" and introduced a fundamentally different direct-to-customer, manufacture-just-what-the-customer-wants business model (sound like web to print, doesn't it?).

Xiameter is a good example of escaping the profit-killing effects of commoditisation. Dow Corning, long-time maker of high-end silicon products sold through a high-margin, high-touch business model, similar to print enhancement digital or analogue, created a whole new business called Xiameter to address decreasing demand for technical support among some segments of its customer base. Rather than cede those customers away to a competitor, it created a radically different business model in which it lowered costs, not only by stripping away support (which would just lower its margins) but by sourcing its product on the spot market, thus dynamically lowering its costs (Vistaprint and Exaprint model).

The point is two-fold. Xiameter did not try to address this new customer need by shoehorning it into its existing model, which would never have worked. And it did not put its head in the sand and say, "Well, we cannot serve those customers profitably, so we will not, and we hope no other competitor does either."

Those are the two clear-cut threats that require new business models, and they are circumstances in which incumbents find themselves in a reactive mode.

But companies can employ business model innovation proactively as well, not to counter threats but to create or capitalise on opportunities. In that case, there are two particularly fruitful circumstances in which a new business model can enable businesses to take advantage of opportunities.

EXTERNAL CIRCUMSTANCES: OPPORTUNITIES

The first opportunity is the chance to "democratise" the market – that is, to open it up to people who have previously been entirely shut out because all current alternatives are either too expensive, time-consuming, complicated, or inaccessible for them (with print app marketing for example). To use the computing world as an example, we went from mainframe computers to minicomputers, to personal computers, to laptop computers, to netbooks and handhelds. And each of those democratising moves, where computing became more ubiquitous and accessible to more people, required a different business model. There is a lot more to it than that, but that is a fairly simple example.

The final circumstance in which business model innovation is needed is to capitalise on an internal innovation that does not mesh well with your current business model. Xerox PARC is the classic sad example – scientists there famously came up with the graphical user interface and the mouse. But those technologies would have required Xerox to take a different approach than just saying, "How does this apply to copiers and the copier business model?" So those technologies ended up in the Apple computing business model. The Ethernet technology went into 3Com, and Adobe used the PostScript technology when it started up.

Rebootmoments tap in the crowd intelligence of your company members

Really, those technologies required three different business models. Xerox was not willing to come up with new business models and therefore did not end up with any part in commercialising any of those technologies.

The only way an individual company can determine for sure whether a particular threat or opportunity requires an entirely new business model is to work up an initial estimate of the business model that could capture the new opportunity (or address the threat) and compare it with its current model. The Swiffer, for instance, although it was highly disruptive to the traditional mop makers, fit squarely within Procter & Gamble's established model for making and distributing household consumables in high volume.

INTERNAL: LOOK AT YOUR CURRENT BUSINESS MODEL

That is why it is imperative for companies to judge opportunities and threats according to their own capacity to meet them (internal innovation workshops and staff education deploy an internal innovation culture). Looking how these opportunities fit with their own business models rather than judge how near or far the opportunity might be to their competitors. Going after a seemingly lucrative opportunity with the wrong business model is the reason so many companies fail in their efforts at transformational growth. Failing to respond to a disruptor in your market because it requires you to develop a new business model can be suicidal, as the big integrated steel companies found out.

Match the four external circumstances to the internal capabilities of your current business model. If responses to those circumstances require changing any of the things I have mentioned above, then you are probably not just looking at a tweak of the business model, but something fundamentally different. Conversely, though, failing to grasp unities like P&G had with Swiffer to disrupt other markets using your current business model is just throwing money away – something companies can ill afford in the current economy. That said, if the opportunity requires a business model that features smaller margins, a much smaller overhead structure, or a dramatically changed resource velocity (that is, a dramatic change in the speed with which assets need to move through the business system, like digital printing allows), it is a good bet that it can only be addressed by setting up a separate unit to run this separate business model.

The same goes for models that need to run under different metrics, norms, or business rules (different gross margins, unit pricing, unit margins, quality measures, time to break-even, individual rewards and incentives).

LUCIEN MOONS *is an expert on strategic innovation and business turnaround, as well as a passionate workshop animator. He started Rebootmoments on request of his customers, looking for solutions to address their decreasing margins and stalling business issues. The benefits of Rebootmoments service are best described by a customer: "Established in 1991, Bittner's vision was to make an express service with added value for its B2B and B2C customers, regardless of their company size. We started to discuss our business model with Lucien Moons at Rebootmoments, in 2000. Since then, every two to three years, we have engaged in a Business Model Rebootmoments discussion, where we have developed various online print platforms for our different markets segments. With the implementation of innovative marketing services and regular alignments with the latest technologies, we have grown steadily by 15 to 25% per year and are now the leader in our market." (Mojo Bittner, CEO Bittner Print)*

MEET LUCIEN MOONS AT ESMA LOUNGE (HALL 3. B70) DURING DRUPA

ESMA MEMBERS IN 2016

Member of ESMA Driving Print Excellence

In 2016 ESMA has reached the record total of 74 members: equipment, software and consumables manufacturers, as well as consultants, printers, resellers, developers. Every ESMA member enjoys advantageous terms at major trade shows and ESMA's own conferences. Other benefits include access to technical seminars and committee meetings. The know-how exchange takes place during educational events, workshops and in three committees: for technical exchange, health, safety & environmental protection and marketing & promotion. Our members receive support and advice regarding business trends, technical solutions, legislation and they all participate in setting industry standards.

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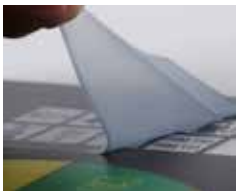

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TRANSFERRING SCREEN PRINT PRODUCTION ENVIRONMENTS INTO INKJET PRINTING PROCESSES. WHAT ARE THE LIMITATIONS AND SOLUTIONS?

by Jochen Christiaens, InkJet Consulting Christiaens

Screen printing production environments exist for years and processes have been optimised over a long period of time. Also the inks have been undertaking optimisation and so became perfectly adapted for their future application. From decorative or functional printing onto papers and cardboards, textiles, plastics, metals and flat and hollow glass or wood, the application range has become widely spread. The main referred application in this article is decoration onto architectural glass with glues, masking liquids and primers. Inkjet printing has evolved throughout the years, from the graphical large format printing market into a true alternative industrial printing solution in all of above mentioned application areas. Newer printhead technologies, inks and substrates made it possible for inkjet to evolve to a flexible, short run, economic and industrial print solution. However, in order to implement this technology into an existing screen printing production environment and fulfil all its requirements, a lot of questions need to be answered.

LIMITATIONS: PRINT QUALITY VERSUS FUNCTIONALITY

Three main factors decide about the success of a print solution: substrate, ink, printhead technology. Only when these three are well adapted to each other, a reliable and industrialised print solution can be created.

In screen printing the selected mesh, the squeegee, the emulsion and the ink will define the print quality. For inkjet, these factors can be compared with printhead parameters and inks. For example, the emulsion border sharpness will define the way the ink shares-off the emulsion and leaves a sharp edge. This will be defined (amongst other parameters) by the waveform in the printhead, defining how and when the tail is "cut off" from the main ink droplet causing satellites or not.

Inks make incredible things possible, but are a very limiting factor at the same time. For screen printing inks, there are almost no physical limitations toward viscosity, whereas this is a main criteria for inkjet ink development. Too high viscosity will cause the ink to behave differently during drop formation at the nozzle and during flight or even on the substrate. Attention: in some industrial applications such as printing glues an extreme fine deposition of thin liquids is not required. In these cases viscosities of the inks cannot be modified without losing the initial properties. These types of liquids cannot be used in common piezo printheads, but need specific dispensing solutions. From a whole range of print technology suppliers it is best to consult an expert to support in finding the best suited for your application.

Inkjet potential for glass decoration is prominently illustrated by the decorated glass walls for indoor use in bathrooms, saunas and pool areas. Hotel Excelsior Munich. Source: skara/ arbucomp

SOLUTIONS WITH DIGITAL PRINTING

Due to increased demand for shrinking run lengths, production flexibility and quick job turnaround, automated pre- and post-press, variable data printing, or cheaper and shorter run productions (just to name a few basic arguments), many typical screen applications are being switched to inkjet printing production processes. What are the ways to get it right?

Print technology selection and use of pre-treatment or primers. Not all characteristics of screen inks can be reproduced in inkjet ink formulation.

One major reason for this is the extremely low viscosity of inkjet inks. Only at such low viscosity levels can they be used in piezo printheads. The difference in viscosities of several 1000s mPas cannot be compensated easily during ink development. Going through a raw material screening can offer an ink formulation with thinner viscosity, but will most probably not offer the initial performance requirements of the screen printing ink. A much easier approach will be to go through a print technology screening and find out which technology can be used with the existing ink formulation. Some inkjet print technologies are specifically developed for use with higher viscous liquids. This way the ink characteristics are not influenced, and the advantages of a digital print solution can be accomplished.

Waveform. If ink has been formulated but is not jetting perfectly at the very start, an optimisation of waveform parameters can change the print quality. Investigating best suited piezo actuation parameters for each ink requires know-how and the right tools. Setting up a suited waveform will require modifying a whole set of parameters (firing frequencies, head drive voltages, temperature range to alter viscosity, shape of the applied waveform etc.).

Available printer systems or a dedicated printer solution. For certain applications, such as for example printing onto architectural glass, print sizes of recently up to 3.2 m x 15 m (used for the Apple Headquarter Building) are required. The maximum screen size however is limited to 3.2 x 8 m. Without generating enormous costs for screen making, there is no economical way to execute these tasks other than using inkjet. Existing printers were used to apply speciality liquids (other than colours) onto the glass and will now expand production capabilities to new businesses and new applications tremendously.

Result of masking liquids for sputtered mirror glass. Each glass sheet has different images.

CONCLUSION

Digital printing is continuously taking over parts of production volumes from analogue printing processes, such as screen printing, flexo and even offset. Thanks to the raised productivity of inkjet printing solutions, with the ever-growing print quality and the capabilities of automatable production workflows, as well as very quick job turnaround, it is becoming the preferred production process. In the graphics market already a big portion of the printed volume has moved from screen printing to digital printing. However, there are still a lot of industrial screen printing applications left to transform to inkjet. These applications have not been shifted, since they have been extremely challenging toward ink- and printing system development. Many innovative solutions are coming to market for these special applications and I would like to discuss these with you during a meeting at drupa. I look forward to meeting you and talking about your desired future industrial inkjet printing solutions.

Examples of new applications on architectural glass with metallic effects or sputtering were achieved by using digital printing technology. Hotel Straubs Schöne Aussicht, Klingenberg. Source: skara/ arbucomp

JOCHEN CHRISTIAENS *is an expert in inkjet printing product development and offers support in chemistry development, setting up digital printing workflow processes, colour management and building reliable and efficient inkjet printing solutions. He works with a network of printhead manufacturers, systems integrators, software developers, institutes and speciality chemistry manufacturers for the development of a digital manufacturing process. With international customers in China, Japan, USA and Europe, Jochen has led product development projects and steered commercial as well as technical aspects with UV large format printer manufacturers. Current projects include architectural glass decoration, glues, primers, masking liquids, decoration and treatment of industrial foils, decoration and brushing of aluminium, and large format full colour printing onto various substrates.*

MEET JOCHEN CHRISTIAENS AT ESMA LOUNGE (HALL 3, B70) DURING DRUPA

COLOUR MANAGEMENT FOR INKJET PRINTING ON HOLLOW ARTICLES. CHALLENGES AND SOLUTIONS

by Oliver Kammann, K-Flow

As the recent ESMA conference on the subject has amply demonstrated, direct container printing using digital inkjet technology is turning into a market segment with considerable growth opportunities. A number of machine manufacturers have in recent times introduced printing machines targeted specifically at directly decorating hollowware, tubes, cosmetic containers and other three-dimensional articles using inkjet as a means of applying graphics onto the container surface. Substrates for these products comprise various plastics, rigid and flexible, metal and glass. Whilst the mechanical intricacies of transporting these articles at speed through the printing machine and depositing the ink onto the substrate with a very high degree of precision and repeatability have been largely solved by the manufacturers, colour management for direct container decoration still remains a mystery and a challenge to equipment manufacturers, printers and converters.

While direct container decoration is not a new technology – screen and pad printing have been used for many years in the decoration of drinking glasses, tableware and plastic containers – the vast majority of products today are decorated by means of applying a label or shrink sleeve. Labels and sleeves are mostly produced using offset or flexographic printing technologies and are usually aimed at mass markets with large quantities of label material produced for any particular design. Usually, printing these labels or sleeves is performed by dedicated offset or flexographic print service providers (PSP) who possess the skills and technologies necessary to produce high quality label stock. Offset and flexographic printing processes used for the production of labels and sleeves are at a very mature development stage as far as printing technology and colour management are concerned. Printing inks, curing, pre-treatment, ink deposition, substrate adhesion – all these aspects have been researched and standardised in depth. A plethora of software, hardware and workflow systems exists that enables machine manufacturers and printers to control the deposition of ink and the appearance of colour. Colour indices, gamuts and output profiles (i.e. the range of printable colours on any given substrate with a certain ink set and printing technology) are well defined, profiles for the creation of colour correct artwork files are standardised (e.g. the ISO 12647-2 standard for offset printing). To a certain extent, this also holds true for screen printing applications. In all three cases, inks for process and spot colour applications are readily available and the predictability of the final artwork poses no challenges anymore. The printed labels are then shipped to the converter who "simply" needs to apply the printed label onto the surface of the articles, using dedicated application machines. So very little knowledge about colour chemistry and colour management is needed at the converters end, since all colour-critical tasks have already been handled by the dedicated print service providers.

The emergence of disruptive digital printing technologies such as inkjet or toner-based systems and the trend towards mass customisation (i.e. frequent image changes and smaller order sizes whilst running at production speeds) is causing a shift both in the ability to produce finer halftone graphics directly on the substrate surface and by enabling integration of printing technology at the very end of the production chain at the bottle filler or distributor. The traditional PSP is no longer an integral part of this process. It is very important to note that this also means that skills and knowledge regarding the entire digital print process and colour management need to be transferred to companies or production stages that previously have had very little or no exposure to the specific tasks and requirements. Even the manufacturers of digital printing machines are in many cases lacking in-depth knowledge and skills as far as colour chemistry and management for inkjet printing processes are concerned. It is a common misconception that digital printing is an easy "push-of-the-button" process. Fact is, however, that the achieved quality of any digital print is dependent upon a whole range of parameters and variables, which need to be understood and tightly controlled in order to achieve the desired output. These parameters and variables include, amongst others, pre-treatment of the substrate surface by flame, corona or anti-static alteration, controlling the temperature of the substrate and ink, optimising nozzle waveform and droplet size jetted onto the substrate, defining curing and pinning strategies to achieve the desired ink laydown, developing ink chemistry so that a fluid remains jettable yet achieves good bonding with the substrate, controlling droplet spray and precise deposition and controlling the airflow between the nozzle and the substrate to avoid droplet flight and shifting. And even if all these factors have been accounted and optimised for the desired application, there still remains the fact that we need to create colour profiles for each ink/substrate combination so that the artwork (which originally is usually built and thus profiled for printing on offset or flexographic presses) still retains the intended visual appearance when jetted onto a certain container

substrate (which might be quite different to standard paper or foil stock). To make things further more complicated, this profiling ideally needs to be done directly on the three-dimensional article.

One distinct feature of printed labels and sleeves is that all colour application and therefore also colour measurement is performed on a flat substrate, usually paper or foil stock. Spectrophotometers to measure targets for profiling are standardised instruments and most RIPs have in-built profiling technologies for quickly achieving highly accurate colour profiles. One could say that this technology is quite mature with very little advances or new developments necessary. If one wants to profile a new set of inks for a given substrate, the process simply involves printing out a range of target files, measuring the individual colour patches (usually an automated process as well) and generating the profiles. The spectrophotometer is placed directly onto the flat surface and a measurement of a particular colour or a whole range of colours can be performed with ease. Most spectrophotometers are designed to shine a light source directly onto the substrate at an angle and measure the reflected light perpendicular to the substrate. To generate a profile of good quality, hundreds of individual colour combinations must be measured, with bigger targets easily reaching 1,000 and more colour patches. Since each patch needs to be of a size suitable to the aperture of the measuring device (e.g. 5x5 mm), all patches together quickly reach the size of an A4 or A3 page.

Whilst this is no challenge as long as one prints onto a flat paper substrate, profiling, for example, directly onto a beer bottle with its very limited "real estate" for the application of colour patches, becomes a real problem. Furthermore, no readily available spectrophotometer on the market is specifically designed to be used with non-flat articles, as the geometry of aperture, substrate and optics and the process of emitting and capturing the light from round surfaces simply has not been intended for this purpose. On glass or PET, for example, printed colours (even with an underlying thick coat of white ink) are not totally opaque, causing a lot of light emitted by the spectrophotometer to pass straight through the substrate and not reflect back into the optic, leading to erroneous readings and a wrong colour measurement.

Colour measurement on paper stock and bottles – the challenges are obvious

So what does one do? For certain materials like flexible plastics it may be possible to cut the bottle into strips after printing and place them flat onto a carrier surface for measuring, but this is neither practical in an industrial sense nor feasible as soon as the substrate is more rigid like ABS or glass. Further, most profiling software applications on the market today expect the printed target to be of a certain pre-defined format with usually all colour patches being placed onto a single or a few sequential sheets. The limited dimensions of a bottle or tube already limit the amount of colour patches that can be applied. The printable area is further defined by the width of the inkjet head or head array. So to generate a sufficient quantity of colour patches for profile generation, quite a number of bottles may have to be printed and measured consecutively. Very few software solutions today are able to fully customise the generation of colour targets both in terms of target geometry and number of patches or patch arrays required – still leaving the question of what to measure them with.

In our opinion, what is needed is a new way of measuring colours accurately and quickly, without the need for direct light reflection, ideally in-line with the printing and/or filling machine itself. This may also mean that we have to think "outside the box" in order to develop applications, hardware solutions and procedures targeted directly at the challenges of direct digital decoration of three-dimensional articles made from any type of substrate. We already see demands from brand owners who not only demand quick and accurate profile generation directly onto the substrate, but to also consider the filled container as the final profiling substrate, as the liquid inside may also have an adverse effect on the visual colour appearance.

We at K-Flow are closely consulting and interacting with manufacturers, printers and brand owners to help develop, implement and provide training for technologies and devices which comply with these requirements and with those that still may arise as this new decorating technology is adopted by an ever increasing number of users. If you have any specific questions regarding any of the topics raised in this article, we would be happy to assist you.

K-FLOW

With a 15-year family-company background in manufacturing of printing machines and prepress solutions for packaging, containers and optical media, including the development of the first industrial digital printing machine for DVD media in cooperation with Indigo in 1999, Oliver Kammann founded K-Flow in 2005 after the sale of his family company. K-Flow operates in two key business areas: development of colour communication software solutions as well as consulting and project management services for all aspects of the colour management workflow for industrial screen, offset and digital printing applications. With a highly dedicated team of colour management, technical and strategic marketing experts at its disposal, K-Flow is known for its lateral-thinking, solution-focused approach to consulting and its unique software solutions throughout the media industry.

MEET OLIVER KAMMANN AT K-FLOW BOOTH AND ESMA LOUNGE (HALL 3. B70) DURING DRUPA

THE SHIFT FROM REVOLUTIONARY TO EVOLUTIONARY INNOVATION

by Steven Harnie, Printrix

When will the next revolutionary technology hit the digital print market and what will it be? A question that kept us busy for many years, one we still would like to be answered preferably several times a year. But as digital printing becomes more mature it seems to be less exciting. Is the end of digital print revolution near? I strongly believe that we have not seen the last of it yet, but new developments will probably appear less frequently. I also believe that we can appreciate the current state of our market more if we look at it from another perspective, as a market that has grown in value through years of work by many individuals and companies.

COMPLEXITY OF DIGITAL PRINT TECHNOLOGY

As solutions are added, choices become harder and integration more complex. Print producers in Europe rely heavily on service and quality, possible only if high quality solutions from several sources are integrated perfectly into an efficient production workflow. Finding these solutions in a very competitive market can be a time consuming and challenging task. Especially when switching traditional high volume production lines to digital print solutions, the whole workflow from pre-press to finishing has to be re-evaluated. A consultant can be useful to guide you through the process and provide unbiased information about the different technologies. But transmitting very complex information requires effort and time. Digital printing is complex because it is a relatively new technology that has not been fully developed yet. The many parts which have been created have not been assembled into a coherent and fine-tuned structure. As a consultant I am specialised in creating production workflows for industrial and textile printing companies, and I spend most of my time connecting different technologies into one efficient ensemble. I can assure you that we are still far away from plug-and-play.

ACCURATE COLOUR REPRODUCTION

Printing saturated or bright colours is nice but it does not make money. What you need is accurate reproduction of the graphic data provided by the customer. To do so, you need to be able to reproduce colours accurately possibly on several application specific systems (different printers, inks, substrates etc.). You cannot reproduce colour accurately even with the perfect printer/ink/RIP-software combination, firstly because they do not exist and secondly, because accurate colour reproduction is achieved by integrating the different products correctly into a compatible and performant production process which is also dependent on external parameters like substrate quality, spectrophotometers, reference colours (e.g. Pantone, RAL, Color Passport), colour standards (CIE, ISO), viewing and lighting conditions (D50, D65) and others. In order to explain all issues that arise when we apply all parameters, I would need to write a very thick book and many have been written already on the subject.

As an example, I would like to explain one issue with spectrophotometers and reference colours: Spectrophotometers are calibrated with reference samples, usually in the form of ceramic tiles. These reference tiles are copies of a master set which comes with measurement values made with an accurate lab-quality spectrophotometer (each set has slightly different measurement values). The calibration of spectrophotometers is required because they use different light sources and different photometers (electronic part that measures light) from different manufacturers. The ceramic tiles are measured by the manufacturer of the spectrophotometer and the correction is programmed into the firmware of the device. But even after calibration there are differences between the values measured by different devices because the calibration is usually done on a white tile or by averaging measurements of additional colour tiles. This issue is known and has been tentatively addressed by

Colour calibration for industrial textile applications

X-Rite through the XRGA standard where the differences are recorded in three-dimensional colour space to improve the so-called inter-instrument agreement. Since the XRGA standard was developed by one leading manufacturer others have been reluctant to adopt it.

Reference colours are also measured with spectrophotometers producing slightly different measurement values than the devices used during the colour calibration of your printer (linearization and ICC profiles). During an evaluation I recorded colour differences with an average ΔE^*_{00}=1.26 and max. ΔE^*_{00}=4.70 between the values provided by the manufacturer of the reference colours and the values produced by several favourite spectrophotometers used for colour profiling of digital printers. These values are close to the deviation tolerances proposed by Fogra for digital printing applications and we have not even started to characterise the substrates and inks on a digital printer. Throwing different spectrophotometer geometries and optical brighteners into the calculation would make the results even worse. Through averaging of several measurements on very unstable substrates like textiles, we manage to get the fluctuations down to around max. ΔE^*_{00}=2 which is lower than the inter-instrument differences.

If you get complaints about colour differences between reference colour swatches and the output of your digital printer, it is not entirely the fault of the company providing the colour calibrations. The fundamental tools used by the digital printing industry are maybe not as rock solid as we think... yet.

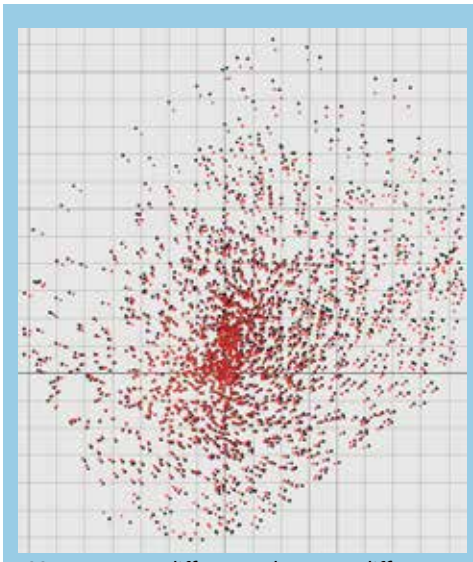
STANDARDISATION

Digital printing still relies on offset printing standards which are not very well adapted to digital printing applications. Initial steps have been taken to create standards for digital printing, by Fogra for example, but this topic needs more attention. Colour accuracy has been debated for a long time and is difficult to achieve even on stable and controlled systems, but colour reproduction with pre-defined tolerances must be possible. Defining tolerances for specific print technologies and creating certifications that allow print companies to prove that they are within industry specifications could reduce a lot of discussions, production downtime and waste of materials.

Colour specifications for digital inks do not exist yet, colour gamut is very different between brands, making it difficult to produce the same colour results on different printers. The specification of colour properties by ink or application type would greatly improve colour reproduction and consistency between different printers. One of the reasons why standardisation of digital inks has not happened until now, is because the printhead technology is still advancing too fast. New printheads are introduced regularly and ink manufacturers have to concentrate on the development of compatible inks, an expensive and time consuming process. Another reason is that inks have to be adapted to very specific applications. This is a sensitive subject and will raise a lot of negative reactions but we should at least leave it open for discussion and evaluate the possibilities.

PRODUCTION AUTOMATION

As the market share of digital printing increases dramatically every year, so does the volume produced. The manufacturers of digital print solutions seem to cope well with the requests for faster printing systems but can you feed these production lines efficiently with the current software solutions from a web-to-print application? Soon you will run into several issues. Can you still rely on graphic artists to prepare the graphic designs? Will your printer operators be able to manage the input and ready everything for printing? How will you manage the administration of hundreds or thousands of print jobs? Production automation for digital printing applications is definitely worth to take a closer look at. Software developers are already reacting to the demands of the market. MIS and ERP systems are being developed for digital print workflows, RIP-software developers are starting to provide connectors for existing ERP solutions, as well as XML-driven hot folders for fully automated image manipulation and file preparation. I expect full production automation to be a fact for most of the digital print companies within the next ten years. It is something you should definitely look out for during drupa 2016 and start asking questions about. There will be a lot of developments during the next few years.



Measurement differences between different spectrophotometers

CONCLUSION

Market trends are ultimately driven by demand. If you are the owner of a digital print company, you can follow the market trends but you also have the power to push the market into a certain direction. My question is this: What do you need most – new innovative technologies that allow you to stand out in the market or an efficient and stable production workflow that allows you to be competitive? Due to the limitations of an article I only raised a few issues concerning digital printing that need a closer look, that is if we want digital printing to become a reliable and efficient technology of the future.

STEVEN HARNIE *is an expert in digital print technologies providing services to print companies, manufacturers and software developers. He specialises in setting up efficient production workflows, advanced colour calibrations, colour management, training, support and technical consulting services for industrial textile printing companies. Additionally, he works with several manufacturers on development of different products related to the digital printing market.*

MEET STEVEN HARNIE AT ESMA LOUNGE (HALL 3, B70) DURING DRUPA

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WHEN AND WHERE?

5-6 OCTOBER 2016

Swissôtel Neuss/Düsseldorf, Germany

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FREE INKJET WORKSHOPS ON 4 OCT 2016

4 OCT 2016, MORNING SESSIONS, 9:30-12:30

INTRODUCTION TO INKJET

Chaired by Johannes Renner & Steve Knight

For those new to inkjet this is an excellent introduction to the background and terminology. Printhead operation, ink types and typical applications are among the covered topics. Workshop includes practical demonstrations using one of the training rigs from The Inkjet Training Programme.

WAVEFORM TUNING

Chaired by Dr Steven Hoath & ImageXpert

Hands-on workshop with the use of the industry standard ImageXpert drop watcher. Participants will be given the opportunity to see how printhead voltage, temperature and the waveform impact the drop formation and how to measure and quantify the results.

COLOUR & PRINT

Chaired by Oliver Kamman & Fogra

From the basics to advanced topics, this workshop will work through the issues of how to manage black throughout the workflow. More complex topics include ICC profiling and metamerism. The impact of store LED lighting and the correct viewing conditions for proofs will be explored.

4 OCT 2016, AFTERNOON SESSIONS, 13:30-16:30

FUNCTIONAL FLUIDS

Chaired by David Chapman

The session explores the practicalities of functional printing with inkjet. From 3D printing, through conductives, to biomedical – David has spent over ten years supporting inkjet into new application areas. This workshop will investigate some of the opportunities whilst being realistic as to the barriers to commercial adoption.

SPECIALITY EFFECTS IN TEXTILES

Chaired by Marc Van Parys

A look at what is in the lab waiting for commercialisation, a glimpse into the future of what is technically possible. Including a range of potential market applications, this workshop is a must for anybody looking beyond colour images.

INKJET IN PACKAGING

Chaired by Sean Smyth

Inkjet-printed packaging will spark a far reaching revolution in product marketing and supply. Today we are just at the start of it with some technical challenges still to be resolved. This workshop reviews the current state of the art and looks at the potential evolution and adoption of inkjet in packaging.

Sponsored by Global Inkjet Systems and Sun Chemical, the workshops are free for the first 100 delegates who book for TheIJC 2016 during the early-bird action until 30.06.2016.

DIRECT CONTAINER PRINT 2017

The inaugural Direct Conntainer Print conference gathered over 120 attendees, including some of the major global brands: AB InBev, Carlsberg, Heineken, Philips, P&G and SABMiller. Together with technology suppliers and packaging manufacturers they discussed the game-changing digital and screen direct decoration solutions for food and beverage, personal care, beauty and household plastic packaging markets.

DCP2017
Direct Container Print

WHO SHOULD ATTEND?

PRINTERS, OEMs,
PACKAGING DESIGNERS & MANUFACTURERS,
BOTTLERS, COSMETIC & HEALTHCARE BRAND OWNERS

WHEN AND WHERE?

27-28 NOVEMBER 2017

Radisson Blu Scandinavia, Düsseldorf, Germany

STATE YOUR INTEREST AT

www.dcp2015.org

"A valuable niche conference which will surely grow a lot over the next couple of years. The topic will surge in its importance across industries, markets, and value chains." Peter Jenkner, Actega

GLASSPRINT 2017

Europe's only event dedicated to glass decoration will return for its 7th edition! Last year 200 glassmakers, glass decorators, end-users and suppliers followed dozens of presentations on advanced technologies for printing onto architectural, automotive and hollow glass with digital and screen applications.

WHO SHOULD ATTEND?

PRINTERS, OEMs,
GLASS MANUFACTURERS, ARCHITECTS,
BEVERAGE, AUTOMOTIVE
& COSMETIC BRAND OWNERS

WHEN AND WHERE?

29-30 NOVEMBER 2017

Radisson Blu Scandinavia, Düsseldorf, Germany

STATE YOUR INTEREST AT

www.glassprint.org

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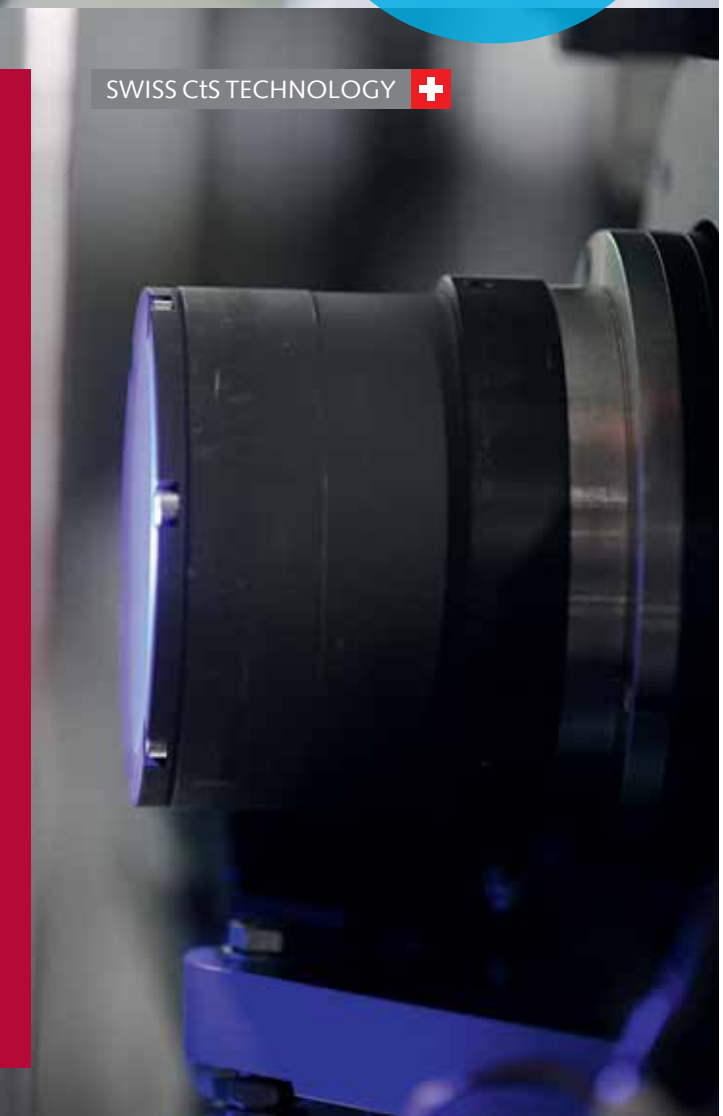

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