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Functional coating developments for the digital manufacturing age

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Abstract

Sihl in Bern has developed for two decades inkjet receptive coatings enabling images to bond with media surfaces and deliver high quality prints. This has contributed to the growth of digital art reproduction, poster and advertising to name just a few applications.

As progress were achieved with inks - better, cheaper, faster drying – demands on matching coating performances kept researchers busy. These were days when everything had to be coated before printing, with price being a second level consideration.

Good things never last forever: progress of inks enables decent to good output on several types of uncoated media. Graphic industry suffers worldwide from lower appetite for print, and tends to accept "good enough" quality in order to cut costs. Manufacturing and 3D printing emerge as the new "hot place to be" for ambitious developers.

Luckily, wide-format printer users are often quite creative and try to add value beyond colour deposition to their activities. Sihl had noticed already some interest for coated materials with enhanced functionalities (water-resistance, fire-resistance, hardened surfaces). We did take some conventional coating contracts, to discover that this was a well-established and rather mature market.

The market opportunities seemed to be at the junction between digital imaging and coating, and a different set of tools were needed to unlock these new markets.

Sihl invested thus into coating line enhancements, adding a station dedicated to the deposition of thick functional materials, so that one pass functional + receptive imaging layer deposition could be achieved at high speed.

Foam deposition is among the first practical developments: Sihl can apply foam layers, with adjusted thickness, softness, printability features on film and non-woven media. The resulting products are of great interest for indoor architects looking for decorative and noise control features.

Longer term, as inkjet devices reach speed and width similar to coating machines, it becomes conceivable to have single-pass on demand manufacturing of complex media or finished products, incorporating variable material deposition, functionality addition and imaging.

Upgrading coating lines for functional deposition

Coating and inkjet have an ambivalent relation: most printer developers aim to build a machine that would print on every uncoated material: media coated for inkjet printing are just a necessary but temporary evil and overcost delaying universal adoption of inkjet.

Coaters such as Sihl have built a good business for themselves with media assorted to diverse types of inks – often as a junior cooperating partner with ink developers. The total printed volumes have grown tremendously, so that the shift of volume production from coated vinyl to uncoated vinyl products did not affect much coating business. Nevertheless, coaters feel compelled to consider a possible future with less or even no need for inkjet receptive coating when imaging alone is considered.

In parallel, coaters also realized that the imaging was a small part of the manufacturing process, and that media preparation and finishing were left behind, or into other hands. They thus started to develop more complex products, to increase their value addition.

Technically inkjet receptive coaters deposit a 10 to 40 gsm/sqm layer in one or several steps. They stand between media priming – less than 5 gsm/sqm – and extrusion or enduction specialists – 30 to 100 gsm and above of fluids and pastes.

One of the first steps was to add appropriate tooling, with a new coating head suited for more solid material deposition.

The coating head enables the deposition of up to 3 mm thick layer of low viscosity materials – foam, pastes and adhesives.

First commercial application implemented was the repatriation of adhesive deposition – now performed in-house in a single pass together with inkjet deposition.

Then came a learning phase, experimenting with a variety of deposits of potential interest, validating feasibility (material preparation, speed and other coating parameters, characterization of process, economic performance)

Foam deposition: combining classic features with digital

Foams are "materials in lightweight cellular form resulting from introduction of gas bubbles during manufacture" (Merriam-Webster dictionary). Deposited on paper, films or textiles, they can deliver several benefits:

- Special haptic,
- Permeability,
- Absorbing properties,
- Elasticity

These classic materials become of renewed interest when combined with digital imaging and finishing.

Going to Market with prototypes:

Thee soft and slightly compressible nature of foam materials can lead to interesting applications in luxury packaging: like in a theatre, affordable materials, images and surface finished are used to convey an ambiance associated with rare, precious, uncommon objects.

Presentation of prototypes went well, but it turned out that industry was quite complex to approach with main decision makers – the designers – used to pick pre-existing media. Business has been so far late to materialize.

Permeability proved to be a more interesting topic: the idea there is to deposit on porous material an uni-directionally porous material to enable liquids or gas to pass through in a single direction (sport & outdoor clothing). Foam surfaces can be imaged digitally, with or without surface coating, this depending upon ink type and quality expectations.

The interest there was more widespread, with several textiles and industrial materials projects started, some combining function and imaging on demand.

Absorbing properties: light, heat or sound or a mix of both. Sound absorption proved to be of interest to architects, as decorative materials are already used to manage sound propagation and prevent reverberation in indoor architecture, especially in public spaces. As these products are considered as construction materials, they are often tightly regulated – ageing, fire rating – and their implementation is complex and into the hands of specialists. It is quite promising but it will take time to turn into commercial products.

Elasticity: protecting goods from external shocks and preventing breakage or surface damage. A very basic idea, but surprisingly one of the most promising, as it is relatively easy to implement and market. There imaging comes as a bonus.

Progressing from concept prototypes to projects:

Presentations on Industrial printing trade shows led to some interesting contacts, and then to relatively long technical discussions before a project could be defined. It seems that the technology options are slightly ahead of market, and that decision makers are still entrenched in the analog manufacturing system, and afraid or weary of the regulations to comply with before marketing digital products.

We did not try the crowdsourcing option. We did try to diversify contacts, taking advantage of investment into the design world through textile and interior products.

It has proved challenging for a small company to allocate resources on possible projects which may take years to deliver a profit and depend heavily upon the commitment and capability of external partners.

Furthermore, Sihl, as the coating Company could offer only a part of a complex manufacturing chain. The Sihl prospects had to combine market understanding and capability to manage downstream manufacturing.

Progress proved to be very slow: unlike design oriented projects, where clients were prompt to move, industrial manufacturing prospects were cautious, demanding complete product visibility before committing.

So, while we learned a lot about market opportunities, business cases still have to materialize around foam coating.

What we could have done in a different way:

As we started with technology, we might have moved quicker to market had we:

- Given priority to simpler projects, where semi-finished products delivered by Sihl is easier to market,

- Associated ourselves with printer manufacturers (OEMs) or ink manufacturers,

We can assume that foam coated products will be used as “blanks” for last minute customization for clients. We can even ask ourselves whether we should integrate customization service in-house, as already often done with personalized glass panel manufacturing.

Conclusion: Digital manufacturing, imaging included

The future horizon is well defined: zero stock, production on demand using a number of qualified base materials – paper, non-woven, textiles, films – adding functional layers and image receptive layer.

The option to integrate imaging and finishing in-line comes in as the technology progresses. With coaters operating at 40 to 100 mm/min, combining inkjet array imaging and inkjet array selective coating/finishing becomes an option.

Longer term we can foresee the emergence of “digital age craft people”, operating with pre-treated materials and adding imaging, finish, cutting and assembly in their workshop – with client present or interacting with final production process.

The alternate is internet/telephone based ordering, with centralized production and delivery to the place designated on order. There e-commerce fulfiller, coaters and printers converge and probably compete for the control of global business process. E-commerce players have the advantage of customer contact, but often lack manufacturing culture. Printers have had a hard time to redefined themselves and see their “territories” invaded by innovators, ranging from copy shops to Amazon.

We believe that coaters, with their manufacturing expertise and understanding of digital industries could be the missing link and become the on-demand manufacturers of the future, integrating production from base substrate to the delivery on demand of materials ready to be cut and assembled into “unique things”.

References

[1] IMI website and publications
[2] Inprint Industrial show presentations

Authors Biographies

Daniel Loosli graduated from Bern university of Applied Sciences in Chemistry, and then joined Sihl as R&D engineer. He is now Director of R&D for Sihl AG in Bern.

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