

XEIKON

DRY TONER INSPIRES WITH HIGHER PRODUCTIVITY AND NEW APPLICATIONS

Whitepaper

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A division of FlintGroup

Introduction

Technologies and raw materials that were previously unavailable to the dry toner process on an industrial scale, are now opening up entirely new development prospects. Xeikon converts this into a highly productive press generation with significantly higher printing speeds and introduces new areas of application for dry toner that fundamentally improve the sustainability of the process.

Dry toner electrophotography is a mature digital printing process and one of the most stable around. Thanks to its food safety properties, the process is widely used in label and packaging printing. This results from the structure of the dry toner. Its carrier material consists of polyester resin, which makes up an average of over 90% of the formulation of Xeikon coloured dry toners. The components contained in the polyester layer of the printed materials consist of large molecules and have a risk of migration that is considered negligible. No other ink system achieves the properties of dry toner in regard to food safety. Liquid toner, for example, has a higher risk of migration due to its potential residual solvent content. With UV inks there is an ongoing risk due to possible photoinitiator residues or remaining monomers in the ink film, which can only be reduced to an acceptable level with considerable effort under inert gas conditions and constant monitoring



Xeikon QB-CH dry toner
(Source: Xeikon)

Market situation

Label and packaging printers have been dry toner digital printing for over 20 years. The sustained organic growth of dry toner technology has been driven by the short process times of digital workflow and its stability, in addition to the aforementioned food safety advantages The long-awaited technological push towards higher printing speeds and greater productivity that the process is currently experiencing, builds on these process advantages. The intensive research work of the industry, the availability of new raw materials, but also legal requirements and changing market conditions are all driving the development of the process.

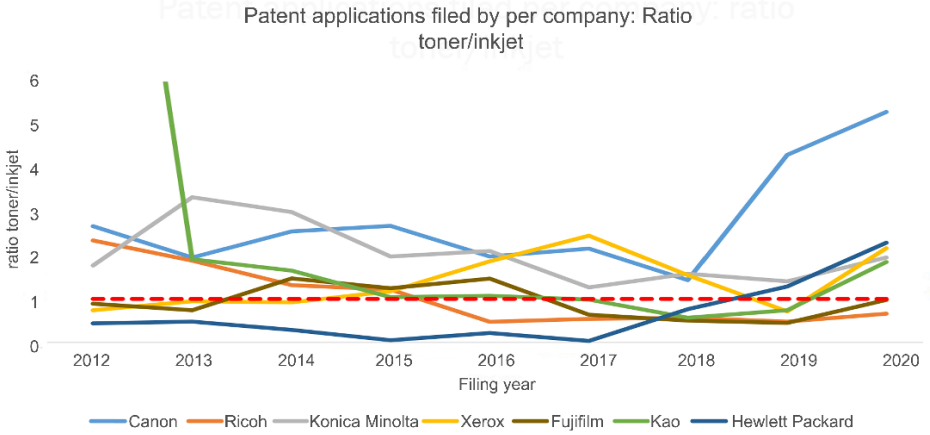
The requirements for packaging in the market are constantly changing and brand owners adapt their portfolio to these conditions. Print buyers demand much more flexibility from converters in the supply of labels and packaging, shorter lead times and ever-greater agility with the shortest possible call-off times for the exact quantities required. Label printers often need high printing capacity to meet these demands.

But the cost situation is also having an impact on the market. Manufacturers who invest in high productivity from their equipment are able to significantly reduce the total cost of printed products. This requirement also applies to electrophotographic processes. That doesn't mean that state-of-the-art toner presses don't meet these market demands. For many, mostly smaller companies, they retain their importance in that the print shops work very flexibly with two, three, or maybe even four presses.

With a job structure that includes longer and longer run lengths, print speed is becoming increasingly relevant, especially when sustainability factors are also becoming important. This demands solutions from the press manufacturers to increase the competitiveness of the dry toner process and exploit its current development possibilities.

Patent situation

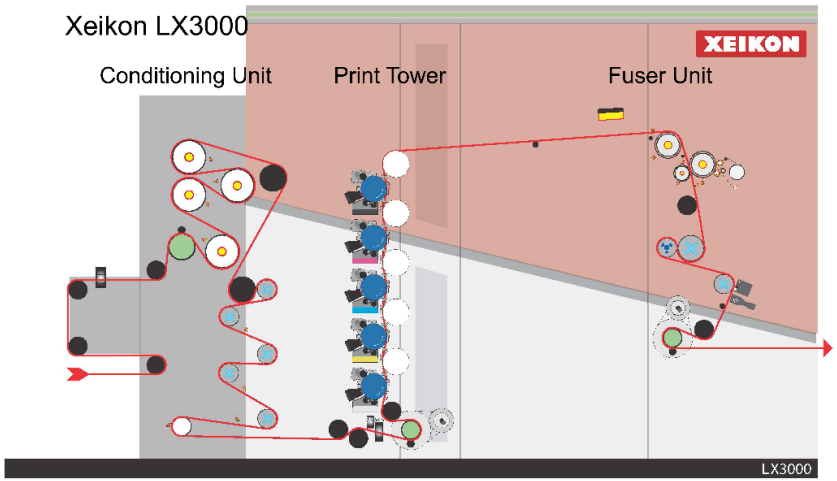
The dry toner process still has a high potential for innovation and this is reflected in the patents being filed. The chart below shows the patent applications of international companies that are active in both inkjet and toner processes. A number above 1 means that a company filed more toner patents than inkjet patents. The timeline shows that inkjet filings dominated the patent situation in digital printing until around 2017/2018. Since 2018/2019, the ratio of toner patents to inkjet patents at these companies has increased significantly, reflecting the increasing relevance that toner patents have for them. Since there are 18 months between the filing and publication of a patent, during which a patent application remains secret, the graphic only shows the status of applied patents in retrospect. There are numerous innovation patent submissions currently still in the implementation phase, which underlines the potential for new developments in toner processes. These are a long way short of fulfilling their potential. While the development of inkjet processes is about to reach its physical limit in terms of speed, toner processes are only now experiencing the anticipated boost in terms of an ideal combination of productivity increase, portfolio expansion, sustainability and food safety.



Patent situation
Since 2018/2019, the ratio of published toner patents to inkjet patents from international companies active in both, toner and inkjet has increased significantly.
(Source: Xeikon)

Xeikon LX3000

With the new digital press LX3000, Xeikon has taken a big step towards increasing productivity. As a high-end printing press, it is designed for the self-adhesive label market. It has 5 printing units CMYK + White and is designed for a web width of 330 mm (13”) with a printing width of 322 mm (12.67”). With its maximum print speed of 42 m/min (137 ft/min), it sets new standards in the productivity of dry toner electrophotography and has a print speed that is 40% faster than comparable press types. With a print resolution of 1200 dpi, it is equipped to meet the highest quality demands of high-end labels. The development of this press needed several steps, addressing many features, which led finally to the success of the innovation, making print speed completely independent from the number of colours being used for the job.



Xeikon LX3000
Construction details of the high-speed dry toner press LX3000 with conditioning unit, print tower and fuser unit. (Source: Xeikon)

Packaging printing with TITON dry toner technology

However, the development prospects of dry toner lie not only in the higher productivity of the process, but also in its expansion to new food safe applications. Xeikon implemented this in flexible packaging with a further development in the toner sector, which is on the market under the name “TITON”. TITON toner can be used to print on fibre-based substrates such as barrier papers. These toners are equipped with the necessary resistance when sealing the printed packages in filling machines, which conventional dry toner types do not have in this application.

Using dry toner in flexible packaging also benefits from the previously mentioned advantages of the process, such as food safety and image quality on fibre-based substrates, over other digital processes.

The heat seal resistance of TITON toner is achieved through the formulation, which contains cross-linkable polymers. The TITON toner molecules and polymers are crosslinked in the printing press by an additional LED curing step.

This cross-linking step in the press immediately after fusing, makes the TITON toner resistant to mechanical and thermal stress, giving it the properties required for use in flexible packaging. The modified layer is also completely odourless and differs in this respect from conventional ink systems in packaging printing, which can contain residues of solvents in the dried ink film.



Seal resistance
TITON toner is seal-resistant, in contrast to conventional dry toner, which only have insufficient seal resistance when used in flexible packaging, as can be seen in this photo. (Source: pack.consult)



Xeikon TX500
The Xeikon TX500 digital press has an LED unit on board for crosslinking the TITON toner, which happens after the powder image has been transferred to the paper-based substrate and the toner components have been fused to the printing material at a temperature of approx. 100°C. (Source: pack.consult)



Flexible Packaging
In the green packaging line of Swiss manufacturer Bschüssig, noodles are packed in barrier papers printed with TITON toner technology. (Source: pack.consult)

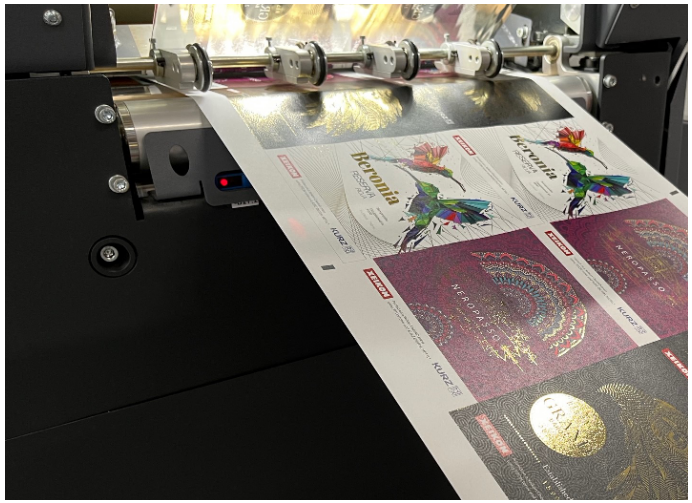
Print Finishing

TITON toner not only enables the printing of flexible packaging, but the temperature resistance of the toner also opens it up to being used in print finishing for label printing, in an unprecedented way. Finished labels convey not only value but also brand characteristics. High quality metallisation plays an important role in bringing out the character of a brand and giving contour to the existing brand profile. For companies that already produce digitally printed labels using the toner process and are looking for extended design options for their customers, the switch to TITON toner offers the possibility of finishing labels and packaging digitally inline, in one production run.



Kurz Finishing Module
In the prototype of a Kurz finishing module shown here, the finishing foil is applied to the substrate. (Source: Xeikon)

For this purpose, a finishing module from Kurz is integrated behind a Xeikon TX500 digital press. The printing tower of the TX500 has five dry toner units, in which the process colours are equipped with TITON toner. In the fifth inking unit, an imagewise dry toner layer with the well-known QB-CH toner is applied. When the web enters the Kurz finishing unit, the image parts printed with TITON toner are heat-stabilised, while the toner layer printed with QB-CH toner is melted by a heated roller. It forms the imagewise and fully variable transfer layer for the finishing foil, which thus bonds to the substrate.



Inline-Print Finishing
Numerous different coloured finishing foils as well as hologram foils are available for print finishing. (Source: Xeikon)

The finishing unit is not only suitable for print finishing, but also for applying security features, including digital numbering or for transferring variable data with metal foil, thus opening up further areas of application to offer customers attractive design options. They are now possible in one single pass using the dry toner process.

Sustainability

Xeikon has long paid attention to the sustainability of the products it currently manufactures or has manufactured in the past. Both the products and the way the company works testify to Xeikon's green way of thinking, which is reflected, for example, in the de-inkability of paper, the use of green electricity, no release of VOCs in production nor in the printing process, to name just a few.

Of course, current global sustainability initiatives have an impact on recent and near-future developments at Xeikon. Currently, the carbon footprint of each Xeikon employee is 19 tonnes CO2/year. In the chemical industry in Europe by comparison it is almost twice as high at 33 tonnes of CO2 per employee per year. And each person living in Europe leaves an average CO2 footprint of 6 - 8 tonnes/year. Xeikon's defined goal is therefore to reduce the company's CO2 footprint per employee by about 50 % in the next few years. All in all, this is a challenge that Xeikon is taking up and behind which is a plan in which raw materials play a crucial role.
Two third of the carbon footprint is generated by the raw materials (20 % resin, 20 % almuminum use) and 15 % is generated from company cars. It is obvious that this is where the priorities for sustainable developments lie in the very near future.

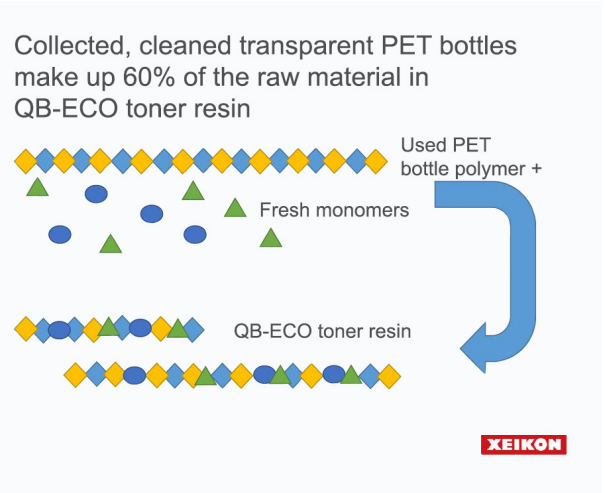
ECO Toner

The platform for ECO toner is also being developed in parallel with the new high-speed LX3000 machine. The innovative leap in this development lies in the sustainability that the new toner generation has.

The collected and cleaned transparent PET bottle is introduced, through a chemical recycling process, to manufacture the ECO toner resin with the same properties, composition and purity as the fossil based resin, but with a reduced carbon footprint. The resin is made even more sustainable by introducing other renewable monomers next to the reused monomers coming from the cleaned transparent PET bottles, increasing the renewable carbon content of the resin to 66,9%.
Since the resin makes up the largest part of the toner recipe, this development step has a very significant impact on the sustainability of the dry toner process. An internal analysis shows that using ECO toner reduces the carbon footprint of printing with dry toner by 10%.

The ECO toner program is currently being set up and ECO toner will be made available in versions for heat-sensitive substrates, i.e. in a low-melting version for example for PP or PE materials and for fibre-based materials in a high-melting version.

The current environmental discussion also raises the question of whether Xeikon QB-ECO toners are free of PFAS (per- and polyfluorinated chemicals), which can be answered in the affirmative together with the fact that the ECO-toner will be 100 % animal free and thus will be usable on packaging for all vegan goods.



ECO Toner
60% -weight percent of the toner resin renewable carbon is coming from collected and cleaned transparent PET bottles. (Source: Xeikon)



Decapping of the PE-toner bottles
The cap of the toner containers is removed in a special device.
(Source: Xeikon)

PE-toner-bottles

Normally, empty toner containers are collected in print shops and disposed of with household waste or are treated as chemical waste, which means that they often end up in waste incineration. There they are used to generate heat, but emit CO2, which should be avoided.

To make the process more sustainable, Xeikon has developed tools that allow customers to uncap the containers and clean them. The complete cleaning is done with an attachment on an industrial vacuum cleaner that Xeikon provides. After cleaning, the PE bottles can be fed into regular clean PE recycling and used again as a raw material without CO2 being emitted into the environment. Next to that Xeikon is also evaluating if recycled PE can be used to make the bottles.

Aluminium Recycling



After polyester, which accounts for the largest share of raw materials by weight, aluminium is the second most important consumable material. Aluminium is a raw material that is very energy-intensive to produce. Production of 1 kg of aluminium generates 8.78 kg of CO2, therefore aluminium plays an important role in the total value of the footprint and also an important factor to look into in order to reduce the carbon footprint.

At Xeikon, aluminium is used in building the press itself and for the production of OPC and fuser drums. The latter two must be replaced from time to time in the digital presses. As the aluminium for the production of OPC drums has to be very pure, it is also a sought-after raw material in recycling. This ensures that OPC drums are fed into the aluminium recycling circuit, where it is then reused. For the fuser drums, different scenarios are being studied to find out which way of reusing them is most sustainable and promising.

What has been achieved, what's next?

Dry toner electrophotography is currently impressing the market with a multitude of innovations, including, some which have taken years of development to be realised. One example of this, is the proclaimed increase in the speed of the process. On the other hand, the technology surprisingly opens up new and unexpected possibilities for its users. Printing on barrier paper in packaging printing or inline print finishing are proof of this.
Overall, the development potential that still lies in the process is very positive. Intensive research and a large number of patent applications bear witness to this.

Not to be forgotten are also the efforts to further increase the sustainability of the process. Using electricity from renewable sources has been implemented. The goal of replacing the existing fleet of company vehicles with hybrid or electric cars in the next two years has also begun.

Xeikon is working on a tool that shows how big the carbon footprint of each digital printing process is in comparison. And collects data to calculate the carbon footprint of each digital printing process. The task begins with the energy consumption in printing and the drying/curing/fixing of the ink. It includes other criteria such as ink consumption and waste arising from the different processes. Conversion tables are ultimately used to give carbon dioxide per square meter printed for each printing process. This is a comparison under defined conditions, to which Xeikon invites other press manufacturers and interested parties to participate. It makes it possible to immediately show what impact the implemented or future reduction of the CO2 footprint has on each square metre of printed material. A tool that stands for the greatest possible transparency in the evaluation of digital printing processes with regard to their sustainability.