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Getting the whites right

Of all the colors used in packaging printing, white doesn't get the credit it deserves.

Dr. John Anderson, Miraclon

Shoppers identifying brands by color on crowded supermarket shelves certainly don't consider it, but without white ink they would have a tougher time finding their favourite products.

White is so important because in many packaging applications, and especially in the fast-growing flexible packaging sector, it provides the foundation all the other colors need to show themselves at their vibrant, brightly-colored best. Without a good, strong white there are a wide range of issues that negatively affect the final print, reducing its impact and perceived value to the customer, and thus undermining the key purpose of the packaging.

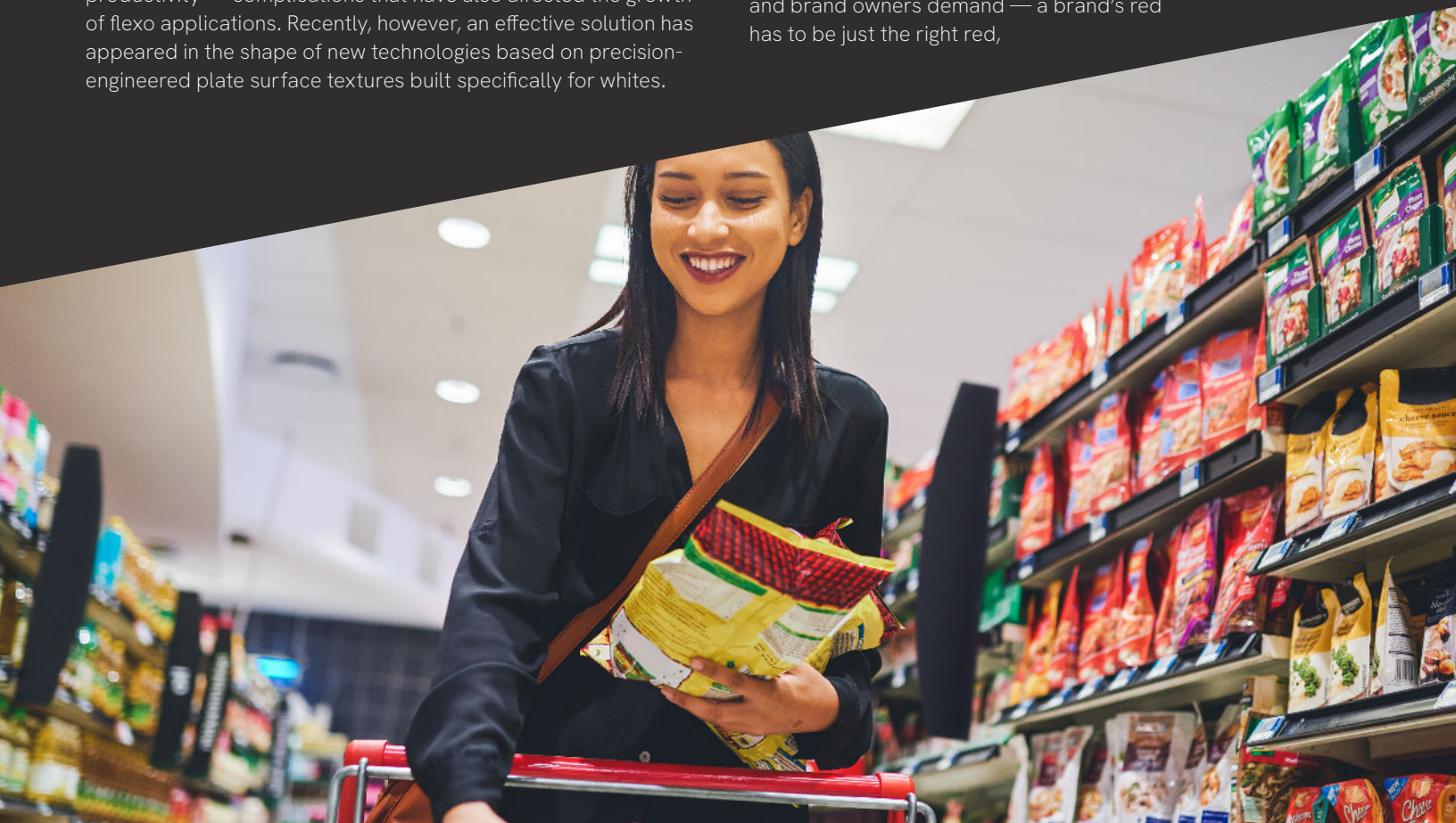
Flexible packaging uses a great deal of white ink. White is typically 50% of the ink spend, but closer to 65% of the ink used, so its performance and the ability to minimise its use are critical factors in future initiatives. Yet printing a good, strong white ink layer is something that flexographic printing has traditionally struggled with. Printers can solve the problem, but often only by adopting methods that increase cost, and reduce productivity — complications that have also affected the growth of flexo applications. Recently, however, an effective solution has appeared in the shape of new technologies based on precision-engineered plate surface textures built specifically for whites.

The essential ingredient

There are numerous occasions in packaging printing when a layer of white ink must be laid down to act as the foundation for subsequent colors: for example, when printing on non-white substrates, on corrugated board, or — of critical importance on flexible packaging — on a transparent film. The opacity of the white ink blocks any color coming from the products, whether beetroot in a glass jar, orange in a plastic soda bottle, or chocolates in a flexible pouch, preventing them contaminating the intended colors of the packaging.

A solid white layer also performs the additional function of ensuring that any ink printed on top will reflect light in a controlled manner. Today, colors are usually built from the four process inks (cyan, magenta, yellow and black), although a growing number of printers are adopting Extended Color Gamut (ECG) process printing, which adds orange, green and violet.

White is therefore essential to the consistent, predictable reproduction of colors that brand integrity depends on and brand owners demand — a brand's red has to be just the right red,



not dirty or pink. Shelf impact is vital to sales in the crowded environment of the supermarket, where there are often over 50,000 products, varieties and versions to choose from. Colors and graphics have to be reproduced precisely as intended so that consumers can identify and connect with products in a matter of seconds. Brand colors also foster and reinforce consumer loyalty to the brand.

Letting the light in

Opacity varies, sometimes depending on the brand owner's requirements, but sometimes on the level of defects in the white layer. One of the greatest challenges with white inks is printing a solid layer without pinholes (holes that allow the color below to show through) or mottle (light and dark patterns).

Pinholes naturally allow light through, reducing opacity. Flexography's difficulty in achieving a good white print is principally because the cell walls in the anilox rolls leave voids in the ink layer (see Figure 1).

This allows all the colors to show through each other, resulting in dirty, inconsistent colors instead of clean, bright vibrant images. While these defects can occur on all colors, they have the greatest impact on white as a foundation color, so that no matter how well the process colors are printed the final result is of "muddy colors".

Traditional solutions come with a cost

Printers can choose from a number of strategies to address these issues, but all have one of two unpleasant side-effects — and in some cases both: they increase cost and decrease press capacity. The most common solution is to use more white ink in an effort to eliminate pinholes. This can be done in a number of ways:

More volume: Increasing the volume of ink will increase opacity, but unless the pinhole issue is addressed this requires significantly more ink — which costs more — and results in very heavy ink deposits. There is also no guarantee that it will prevent contamination by whatever lies beneath the white layer, so the colors may still appear muddy. A further downside is the increased drying time required, which necessitates running the press more slowly, reducing capacity and productivity.

Extra "hits": Two or more "hits" of white ink are commonly employed to fill the voids, effectively plugging the pinholes and giving an acceptable ink laydown. To do this, two or even three printing stations are used, using anilox rolls with different lines-per-inch rulings, so that the patterns do not match.

This solution, however, typically consumes 50% or more extra white ink than does using a single station. This not only adds greatly to costs but also to drying time: because the energy used for drying on-press is predominantly concentrated on the white, printing speeds have to be reduced to enable effective drying of the white ink.

Buy more expensive ink: Finer grades of white pigment tend to print better, with fewer voids — but, again, the cost is a lot higher.

Surface textures are the answer

Over the last seven years considerable effort has gone into finding a way to print the thinnest-possible ink layer, that is pinhole- or defect-free, gives the smoothest ink laydown, meets the target opacity value, provides the optimum foundation for the printed colors, and does so at the highest production speeds. In addition, and of critical importance, all these things have to be achieved at the lowest effective ink cost (which does not mean using the cheapest ink).

Three approaches in particular have been explored: improved plate materials, random surface patterns, or engineered surface textures, and solutions based on the last two have been the most successful in increasing ink transfer. However, applying random patterns suffers from an inability to apply the features locally to keep printing clean, or enhance the final result. There is also always a compromise between the pattern and the applications, process vs. white, solvent vs. UV inks, etc. Consequently, the only truly flexible yet highly-controlled and consistent way is through precision-engineered surface textures applied electronically in the files and in imaging.

Figure 1

The NX Advantage approach

This is the approach of the NX Advantage Technology for the FLEXCEL NX System. NX Advantage comes at the problem from the direction of ink transfer and laydown and recognises that the engineered surfaces developed for process printing, coupled with low-volume anilox rolls, do not function effectively with white inks and higher anilox volumes — and vice versa. There is therefore a need for surface textures engineered specifically for the higher ink volumes used for white inks compared to process inks.

NX Advantage technology added more features to the highly-successful FLEXCEL NX System, which has been helping printers to transform the capabilities of flexo printing since 2008. An Advanced set of new patterns is based on Miraclon's experience that flexo is too diverse a printing process, with too many applications, for a single pattern of surface texture to work; a range of patterns is necessary, and the most efficient way to apply and control these is during imaging. (See Figure 2)

More choices, less complexity

The new patterns give printers a functional series of options, without excess complexity. By building a series of surface textures, using progressively increasing volumes of ink carried on the surface, printers can use the solution that matches their ink/anilox/substrate combination, and optimizes on-press production and productivity. Today the vast majority of flexible packaging printers using solvent-based inks are using pattern A01 for process printing and A03 for white applications. But as the ink system, substrate, or end application changes, they can choose the solution that offers them the "sweet spot" for a particular application.

Patterns are selected in a logical manner, using a unique approach that pairs precisely-imaged micro-level plate surface patterns with anilox volume to facilitate optimum ink transfer across a wide range of applications. The result is the ability to significantly reduce pinholes in solid areas and achieve greater color density and opacity with a lower volume of ink. On-press the print runs clean and fast due to the automatic implementation of the patented Advanced Edge Definition (AED) technology. AED is imaged into the edge of all advanced plate surface patterns to control ink and airflow and guard against any risk of "dirty" print at high production speeds. (See Figure 3)

Getting the Whites right

The FLEXCEL NX technology offers printers a fundamental control tool for printing a white layer that meets opacity targets with the most efficient ink laydown, as illustrated in Figure 4 (next page) — an elegant solution to a fundamental flexo challenge.

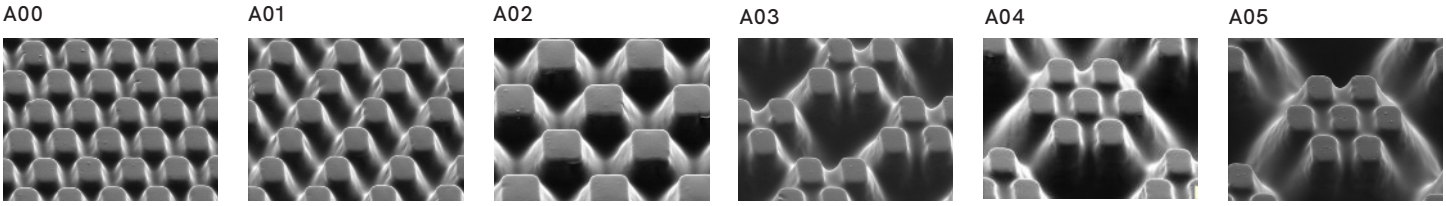


Figure 2: Expertly-engineered Advanced DIGICAP NX Patterning enables a single plate to be optimized across a wide range of print conditions, all ink types and anilox volumes

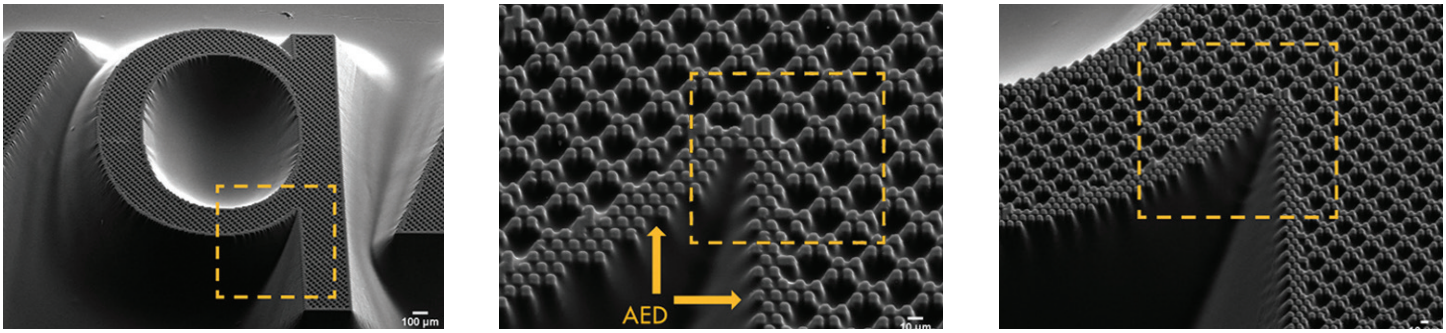
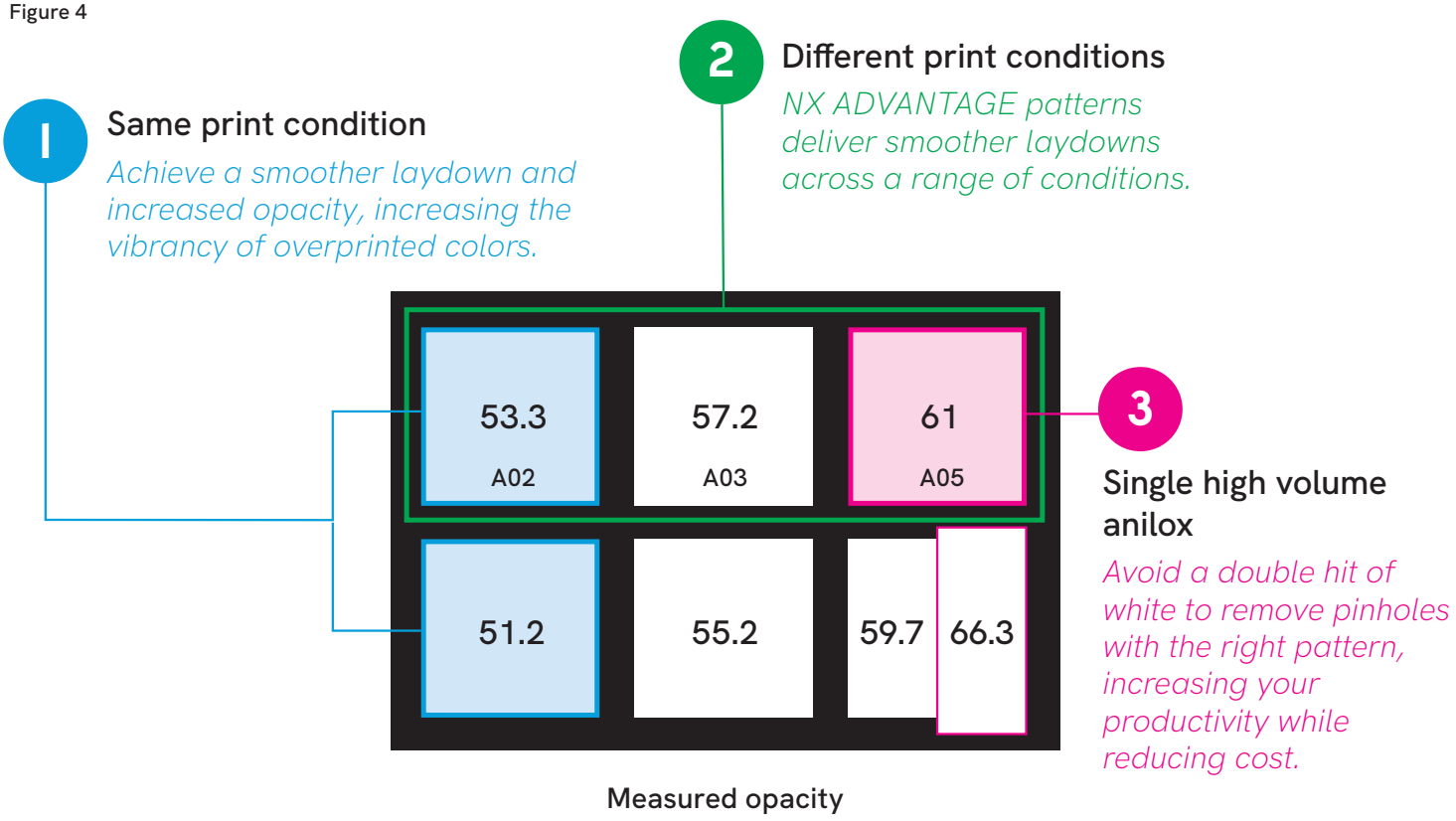


Figure 3: Patented Advanced Edge Definition technology

Figure 4



To learn more about FLEXCEL NX systems and to contact a Miraclon representative, visit **www.miraclon.com/go/flexcelnx.**

About the Author:

Dr. John Anderson is Director Advanced Print Applications for Miraclon. A Mechanical Engineer and graduate of University of Wales, Swansea, he has a background in packaging printing and the implementation of new techniques for flexographic, gravure, offset, screen and digital printing. Formerly the technical and education director at the English and American Flexographic Technical, he joined Kodak in 2007, where he held various roles in product marketing, sales, business development and product development.
In his current role with Miraclon, he works with leading global print companies and brands as they explore options to optimize packaging supply chains, including the conversion of gravure print production to flexo. He is also a key product architect for the next generations of FLEXCEL NX products.