Design Business Solution: Pro6410 NeonColor and C942/Pro9542

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Pro6410 NeonColor is OKI Data's first A4 LED color printer to utilize fluorescent toners (fluorescent cyan, fluorescent magenta, fluorescent yellow, fluorescent white). Furthermore, the fluorescent white toner is switchable with standard black toner enabling presentation of accurate blacks.

Photo 1. Pro6410 NeonColor Fluorescent Toner A4 LED Color Printer

The C942/Pro9542 are A3 LED color printers that strengthen the media support of the highly reputable MICROLINE VINCI*1) series and are specialized for high-speed, high-accurate printing of white spot color on the lowest layer.

Printed products are commodities in the design business, and in recent years, there is an increasing demand for printing equipment that provides printed products with additional value.

Pro6410 NeonColor and C942/Pro9542, which provide new values, are introduced below.

Photo 2. C942/Pro9542 A3 LED Color Printer

Pro6410 NeonColor's Target Market and Product Concepts

(1) Target Market

Toner transfer system consisting of a printer, transfer paper and iron press is in widespread use with print shops producing and selling original t-shirts.

In this system, the printer is first used to print out the design on a transfer sheet, which is then hot pressed onto the t-shirt to complete the product.

In addition to the conventional CMYK colors, print shops such as the one described above are demanding the capability to handle white and fluorescent colors, so they can broaden their design creativities.

(2) Product Concepts

To broaden the design spectrum of the print shop market, the Pro6410 NeonColor was developed on the three concepts of "new presentations with fluorescent toners," "unique presentations with UV light-emitting toners," and "accurate black presentations with switchable white and black toners."

For "new presentation with fluorescent toners," new toners were developed. This enabled vivid color presentations that are unseen with conventional CMYK printing.

New toners that illuminate when irradiated with black light were developed for the "unique presentations with UV light-emitting toners." The toners not only broaden the design spectrum, but it can also be used in various other applications using black light.

A mechanism was developed to enable "accurate black presentations with switchable white and black toners" on a single printer. Black presentation becomes weak using only fluorescent CMY, so the fluorescent white toner was made switchable with standard black toner to achieve accurate blacks.

*1) MICROLINE and VINCI are trademarks of Oki Data Corporation.

Key Technologies for Realizing the Pro6410 NeonColor Product Concepts

(1) Fluorescent Toners

Fluorescent toners must be vivid to stand out from normal color toners. Therefore, a technology to use pigments that emit fluorescent color was developed. **Figure 1** shows the characteristics (hue/chroma/luminosity) of the developed fluorescent magenta toner. It can be seen that the luminosity is higher than the normal magenta toner.

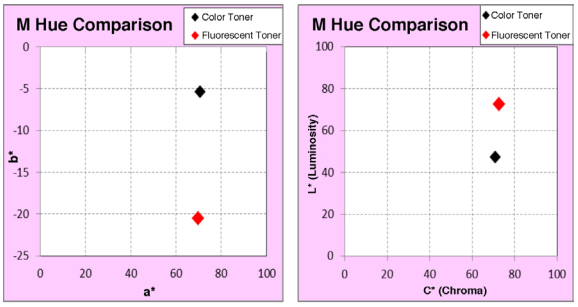


Figure 1. Fluorescent Magenta Characteristics (Hue, Chroma, Luminosity)

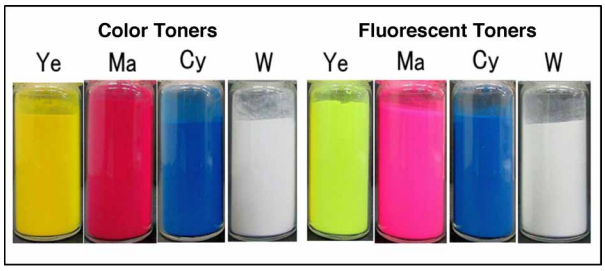


Photo 3. Comparison of Color Toners and Fluorescent Toners

(2) UV Light-Emitting Toners

Light commonly referred to as black light is UV light, i.e. light source emitting ultraviolet light, and the normal peak wavelength is 365nm or 254 nm.

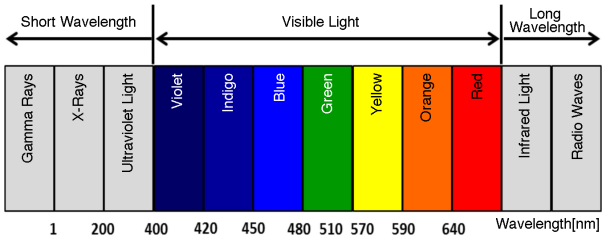


Figure 2. Electromagnetic Spectrum

Each fluorescent toner (yellow/magenta/cyan) were added with pigments that emit a different color to create new toners, which illuminate in green, red and blue colors when irradiated with UV light (**Photo 4**).

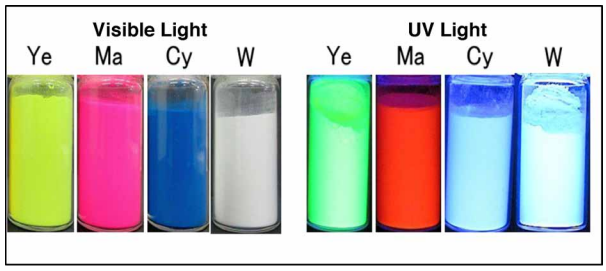


Photo 4. Light Emission with UV Light

(3) White/Black Switching Function

White presentation is an effective design feature on dark colored t-shirts. Reverse is true on white t-shirts where black presentation is important. To respond to both needs, a function to switch between fluorescent white and standard black toners was developed.

Of the four print cartridges in the printer, the fluorescent white toner was placed at the most downstream position of the paper feed direction. At the most downstream position, if color shift correction does not function properly, effect on the image becomes a concern. Additionally, imaging using the correct density is necessary to represent the color image accurately. Furthermore, the characteristics of white fluorescent and standard black toners are different. Therefore, in order to correctly detect and control the white fluorescent and standard black toners, it became necessary to re-examine the detection components and control method used in previous CMYK toner printers. Since the detection components had large sensitivity variations, the components' sensitivities were screened. The white fluorescent and standard black toners have separate controls, so that each receives the optimal voltage for imaging.

To ensure the user correctly operates the white/black switching function, a message for switching is displayed on the printer's control panel.

C942/Pro9542's Target Market and Product Concepts

(1) Target Market

Generally, color printing is presented with CMYK toners, but there are cases when white is used to print on special media. Examples are printing a white base on to a transparent film or a transfer paper.

In addition to white paper printing, there is an increasing demand for value added printouts using colored paper.

(2) Product Concept

The three concepts behind the development of the C942/Pro9542 are “reduction of color overlapping and misalignments,” “improvement in print speed,” and “vivid color reproduction on colored paper.”

In the “reduction of color overlapping and misalignment,” attachment position of the white spot color imaging drum (white ID)/toner cartridge (white TC) and the control of the one pass operation (operation of feeding the media through the printer for one cycle) to print white on the lowest layer were changed to reduce the white and CMYK misalignments.

The previous C941/Pro9541 models were also equipped with white spot color, but only the white color was printed during the first pass and the media was backed up inside the printer for a second pass to print the CMYK. The mechanism in this operation caused considerable misalignment to occur.

When printing was switched from two-pass to a one-pass operation, the time required to print was reduced, hence an “improvement in print speed” and an improvement in printing productivity.

For “vivid color reproduction on colored paper,” the white toner was improved and transfer adjustment was made to increase the white density. This improved the masking effect on colored paper producing a more vivid presentation of CMYK toners.

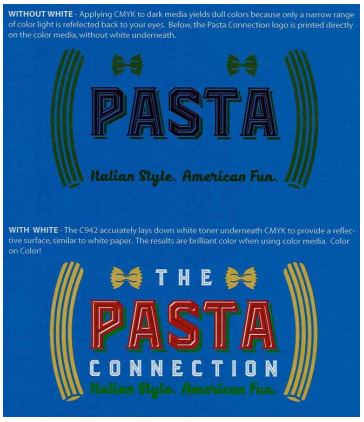


Photo 5. Difference With (bottom) and Without (top) White Base

Key Technologies for Realizing the C942/Pro9542 Product Concepts

(1) White Density Improvement

The previous C941/Pro9541 models stepped-up media support of the MICROLINE VINCI series (OKI Data’s first printers to adopt the intermediate transfer system), but the white ID was placed upstream ahead of the other colors’ imaging drums. When simultaneously printing white and colors with this setup, the bias from the primary color transfer caused reverse transfer of white toner to occur making it difficult to raise the white density. In the C942/Pro9542, position of the white ID was moved to the end of the stream, which eliminated the reverse transfer problem and successfully increased the white density by 20% (**Figure 3**, **Figure 4**).

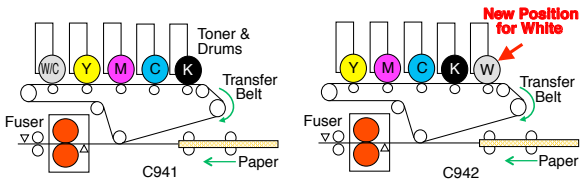


Figure 3. White ID Position of C942/Pro9542

Figure 4. White Density Characteristic of C942/Pro9542

(2) Reduction of White Toner Bleeding

Normally, large quantities of metallic pigments such as titanium oxide must be added to the white toner to ensure adequate masking. This makes it difficult for the toner’s charge to build up resulting in a phenomenon known as “bleeding” where toner images appear in places other than the intended positions on the photosensitive drum. Since the white ID in the C942/Pro9542 is at the most downstream location, it was possible bleeding could occur at the second transfer roller or media. Therefore, chargeability of the white toner was improved and bleeding was reduced to about 1/4 (**Figure 5**).

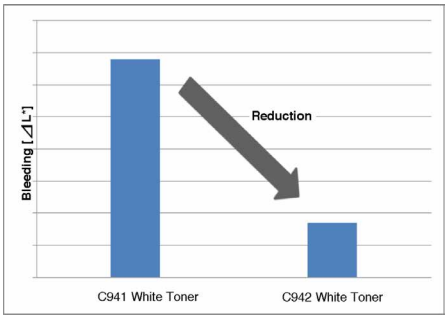
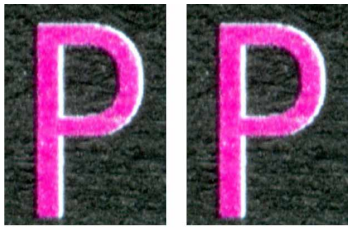


Figure 5. White Toner Bleeding in C942/Pro9542

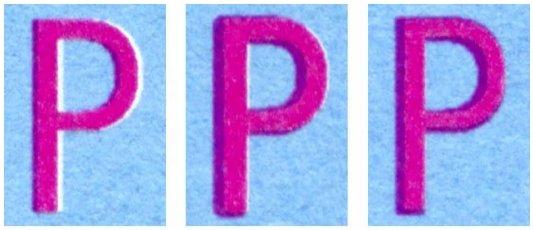
(3) Expansion of Trapping

The biggest challenge with white toner printing is the masking of the background color to eliminate the effects on color reproduction. **Photo 6** and **Photo 7** show examples of printing on black paper and blue paper, respectively. When printing misalignment between white toner and CMYK toner occurs, gaps appear at color boundaries causing the white toner to be exposed (**Photo 6(a)**, **Photo 7(a)**). Since the contrast of white toner is much higher than the other colors, even the slightest gap will be conspicuous. Hence, trapping process becomes important.



(a) (b)

Photo 6. Black Paper Printing



(a) (b) (c)

Photo 7. Blue Paper Printing

Thickening CMYK toner printing and thinning white toner printing are the two methods for preventing white gaps. Process of thickening CMYK toner printing suppresses white gaps (**Photo 6(b)**, **Photo 7(b)**). However, if the background color is bright as with blue paper, color mixes with the background and makes the object look fatter (**Photo 7(b)**). In such a case, thickening of CMYK toner printing is reduced and white toner printing is thinned to suppress the fattening of the object (**Photo 7(c)**).

Along with preventing the occurrences of white gaps, the C942/Pro9542 was designed to allow the combination of thickening CMYK toner printing and thinning white toner printing to prevent image quality deterioration caused by object fattening/slimming.

Thus, trapping that does not degrade image quality was achieved.

Conclusion

Pro6410 NeonColor and C942/Pro9542 are new products developed to bring additional value to printed products. The goal of OKI Data's Design Business Solutions is to provide unique printing on unique media and achieve printed products of high value that leads to customer satisfaction.

Utilizing its LED technology, advanced media support, wide variety of toners and high-precision control technology, OKI Data will develop new values for printed products, contribute to customer's business, and continue with the challenge to create new products. ◆◆

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【Glossary】

Spot color

Special color, which cannot be represented with CMYK (process colors), or pre-formulated color or ink.
White, fluorescent colors and metallic colors such as gold and silver are referred to as spot colors.

Intermediate transfer system

Method in which toner from each imaging drum unit is transferred to an intermediate transfer belt and the combined toners are transferred from the belt to paper.
In intermediate transfer, the toner is transferred from imaging drum –> intermediate transfer belt –> paper.