

# Custom Colour in Digital Printing

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## Introduction

According to the application different kinds of colour printing are used. We can distinguish between highlight colour, custom colour and full colour printing.

4-colour printing with the four process colours cyan, magenta, yellow and black is used for applications, where many different colours are needed in a document e. g. chromatic pictures.

For dedicated colours, spot colour printing is common practice (see table 1). Specific coloured inks/toners are applied which surpass the gamut of four colour printing by far. Spot colour printing can be classified in highlight colour printing, where no specific colour values are required (the colour is used for results, highlighting messages or signatures) whereas for logos customised colours are needed.

**Table 1. Comparison of the Properties of Spot Colour and Full Colour Printing**

	Spot Colour	Process Colour
Colours	predefined	multiple colour
Printing units	2	4
Colour gamut	comprehends all colours	limited chroma
Applications	Logos, signatures, accentuation	photos, chromatic pictures, multicoloured masters
Ink/Toner layer	1	up to 4

Up to now in digital printing black and white printing and 4-colour printing is established. Contrary to the conventional printing market, custom colour printing is not prevalent.

## Custom Colour in Conventional Printing

In conventional printing, a wide market relates to two colour printing with customized colours. Compared to a black-and-white document, colour lets you skim, sort and acquire information faster. Colour documents attract attention quicker and invite viewers to linger longer. Colours draw the viewer's eye and direct the focus on what's essential.

Furthermore colours generate identity and distinctiveness. So it helps to differentiate a firm or a product from its competition. Virtually all companies use a specific colour in their corporate identity (CI) that's a hallmark of the company. Corporate colours are often

generated using specially manufactured accent or custom colours. Frequently these are brilliant colours which can't be satisfactorily reproduced in 4-colour printing.

In business and industrial practice, printed collections of colour samples are used, as references for spot colours. These samples are coated with colour blends of the primary colours in different combinations. In general about a dozen basic colours are used. By colour blending up to over 1000 different colours are printed and named. Most important and widely used colour sample collections for the printing industry are Pantone and HKS (Europe).

## Océ's Custom Colour Solution

For several years, Océ Printing Systems has been providing its customers with specific colour toners for digital printing. Until now, however, long development times (more than a year) and very high costs were required to provide such individualised business solutions.

In spring 2002 Océ therefore has finished a development project, designed to create customer-specific colour toners more economically while avoiding the long development times and associated high costs. The goal in the program was to cover most part of the spot colour space.

As a result, it is now possible to produce customer-specific toners "on demand". These toners can be produced in a short time and can also be ordered in smaller quantities, as low as a few kilograms with a Océ patented process. A wide colour gamut can be covered with the special designed colour toners that surpasses the gamut of full colour printing by far.

As basis for the custom colour the project started with seven toner colours. These basic toners can be combined to toners of the individual adopted colour. All basic toners achieve light fastness level which is equal or better compared to standard offset scale inks. CustomTone<sup>®</sup>-toners are available for Océ's Pagestream, Varioprint and Variostream printer family. The toners can be very quickly developed and delivered according to the customers needs. Colour changes in the printer can be accomplished within few minutes by quick changeable developer stations.

## Colour Matching

In conventional printing colour matching with inks is based on mathematical calculation (Kubelka Munck's Theory). This theory underlies on the circumstance that

the ink layer is of homogenous colour. The diameter of the pigment particles must therefore be in the same range as the wavelength or smaller. For colour systems which are based on dry toners, where every toner particle has a diameter of several micron, the layer is inhomogeneous in colour (see figure 1). With this mathematical procedure sufficient accurate results may not be obtained for digital printers. For certain colours the deviation is higher than  $10 \Delta E^*_{ab}$ , which is not acceptable for most applications.

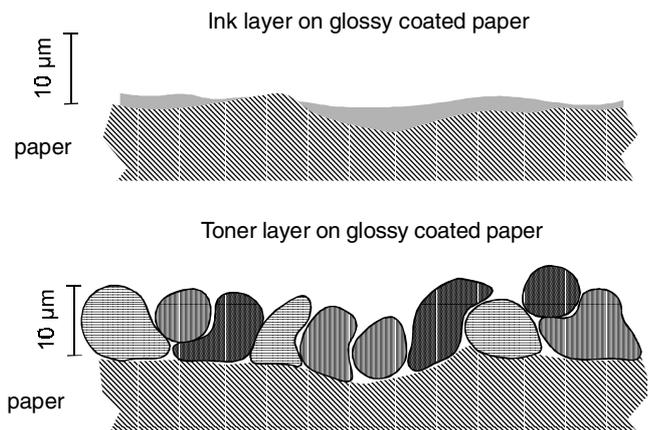


Figure 1. Comparison of ink layers with toner layers

An independent colour matching solution was to be designed which considers the special characteristics of toner layers. As a result a computer based solution was developed, where for every colour a high accuracy is achieved in the first step. Prior first order, every customer obtains a print sample with the matched colour and a order number. All data are stored in a world wide database for recipes and customer data

### Colour Gamut Comparison

Figure 2 demonstrates the colour gamut in the CIELAB-system. The dashed line shows the colour gamuts of common colour swatches which are used to identify the customized colours (e.g. Pantone, HKS,...). It can be easily seen, that the gamut of 4-colour printing is limited, high chroma values especially in the red-orange, green and blue region may not be achieved. But these colours are most important for custom colours. Customers prefer for their companies and products high chromatic colours especially in blue and red region. A comparison shows, that only a small part of the customized colours can be achieved with 4-colour printing (below 30%). With Océ's solution over 80 % of the desired colours can be printed.

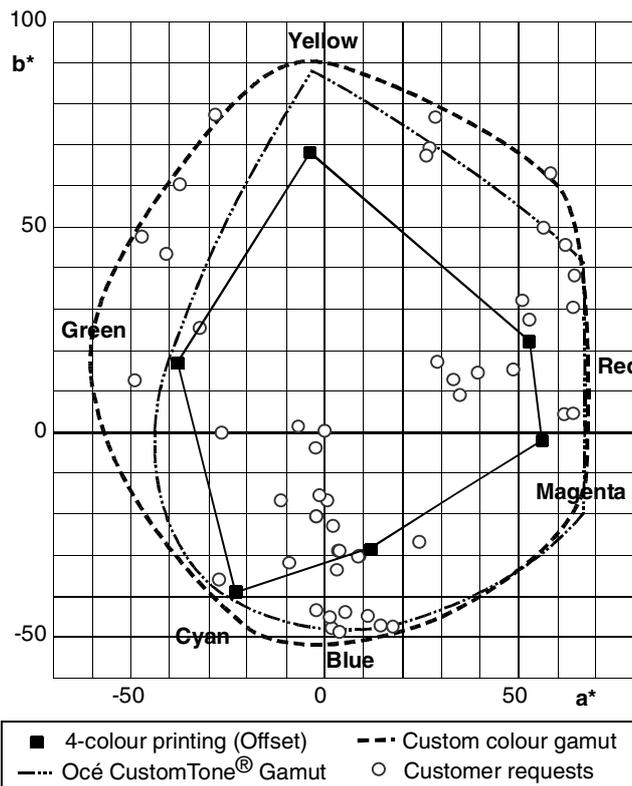


Figure 2. The limits of process and spot colour printing. All data are applied to uncoated paper.

### Results from the Field - Conclusion

Although customer can choose over 100 different colours from a Océ colour swatch, most of them have individual wishes concerning the exact appearance. Customers expects that colours matches on their individual paper. Furthermore a print sample is often compared with a offset preprint and not with the color reference of the company.

All CustomTone® colour toner show excellent colour stability during printing. For the optimization of the benefit of colours in documents, a redesign of applications is necessary.

### Biography

**Andreas Paul** studied physics at the Ludwig-Maximilians-Universität in Munich (Germany). From 1991 he worked at FOGRA-Institute in Munich in the colour and ink department. His work has preliminary focused on ink transfer and colour measurement in conventional printing. In 1997 he received his PhD from Hochschule der Künste, Berlin (Germany) on calculations of colour variations in conventional printing. Since 1998 he works in technology development department of Océ printing systems in Poing. His application areas are the digital colour printing and print quality. For the optimization of the benefit of colours in documents, a redesign of applications is necessary.