BETA INDUSTRIES
The Quality Control Company
707 COMMERCIAL AVE. CARLSTADT, NJ 07072 USA
201-939-2400, 800-272-7336, Fax: 201-939-7656, www.betascreen.net, e-mail: sales@betascreen.com

October 29, 2018

Beta FLUO Invisible UV Fluorescent Ink Spectrophotometer for Anti-Counterfeit Print Control

Beta Fluo Invisible UV Ink Densitometer

INTRODUCTION

The low cost and ease of use of invisible UV fluorescent inks make them a popular choice as a first line of defense against document forgery. Available for many print methods such as offset, flexo, inkjet, screen process and others, they extend the use of existing equipment without additional expense.

The same ease of use that encourages their adoption by management and use by production personnel may also lull them into a false sense of security regarding print quality and process control. The wide variety of organic and inorganic pigments can be used to provide a nearly full visual color spectrum of fluorescent effects. Impossible to see under normal room lighting, the need for solid and halftone tone control can easily be overlooked.

Conventional inks have long enjoyed the benefits that rugged, portable, easy to use instruments have brought to the pressroom and Quality Control department. Using either opaque or transparent inks, “ink film thickness” correlates to optical reflection density which in turn relates to the visual appearance of the printed piece. The optical reflection color density of the process color inks of cyan, magenta, and yellow is determined by using complementary color channels of red, green, and blue respectively. The higher the measured density, the darker or stronger the visual effect.

To achieve the same high level of image quality, invisible UV fluorescent inks require similar measurement and control techniques. A new instrument from Beta Industries, the **Beta FLUO invisible UV fluorescent ink spectrophotometer** now makes that possible.

THE PROCESS

Invisible UV fluorescent inks require a different method of measurement than conventional inks. In conventional printing by any of the common methods such as offset, flexo, inkjet, screen process and others, the substrate is typically white or near-white and represents the highest brightness on the printed piece. Any ink applied to the substrate reduces the brightness and may also be used to introduce color effects. When overprints of colored inks are used the inks need to be transparent, as the white substrate functions as a light source behind the colored inks.

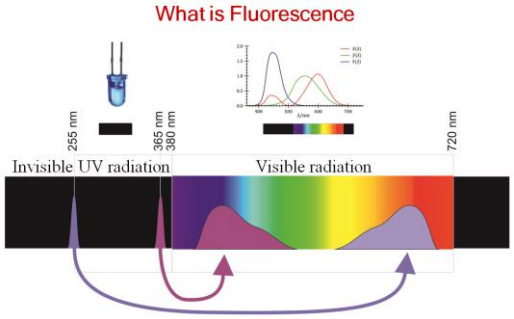

Fig 1. What is fluorescence?

Fluorescent inks operate in a different manner. The substrate makes no useful contribution to the visual effect, as the pigments absorb the UV energy and emit the visible fluorescence. Variations in the brightness or tone of the visible fluorescence are a function of the emission of the pigments, not their reduction of the brightness of the substrate.

Measurement of the brightness of the UV fluorescence requires an instrument that illuminates the sample with the proper wavelength(s) of UV energy. The brightness or intensity of this signal is a function of the pigment, and interactions with the other ink components such as vehicles, solvents, etc. Any emission from the substrate is deemed undesirable and must be factored out of the measured value.

Color is a strong differentiator of visual effects and is put to good use in the printing process. As photography progressed from black and white to full color, measuring processes kept pace.

The **intensity** of the UV fluorescent effect is only one aspect of its characteristics. The absence or presence of a UV fluorescent mark is the lowest level of authentication.

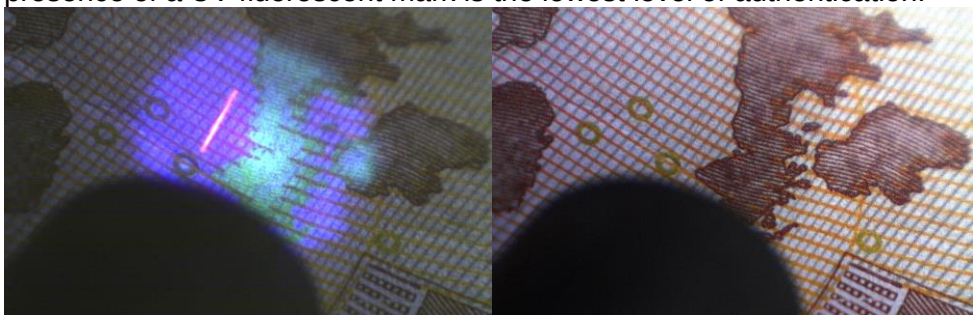

Fig. 2 Presence of an invisible UV fluorescent mark

The exact color can also be used as part of the authentication process. Numerous color measurement and description systems have been developed and are widely deployed in various industries. Some are absolute and do not take into account the psycho-physical properties of the human visual system. Other systems correlate very well with the human perception of color and color differences. Tristimulus values are the basis of all vision-related color description systems, and are calculated by the FLUO.

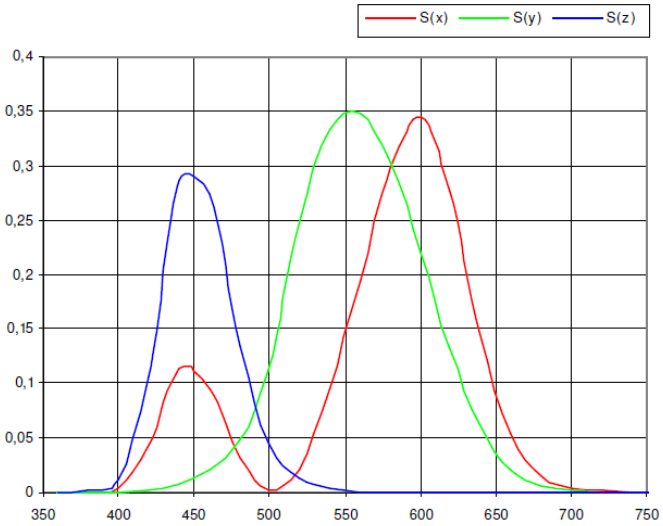

Fig. 3 The human visual color Tristimulus response curves

With a numerical method to describe any color and a convenient instrument to measure any color, Process Control techniques can now be applied to fluorescent inks in a manner similar to the control of conventional inks. The density of a conventional ink can be related to the intensity of a fluorescent ink. Low density is a common complaint often caused by mechanical or chemical errors in the printing process, causing insufficient ink to be transferred to the substrate. Low intensity of a fluorescent ink can be caused by insufficient ink transfer, excessive dilution of the ink, clogged screens or inkjet nozzles, etc.

When shades of gray or colors are required in a design the halftone process is employed. Using either ordered or random arrangements of microscopic spots of ink, any percentage of the solid density can be obtained by varying the coverage of these ink deposits. Ordered arrangements form the familiar dots, laid out in rectangular grid pattern created by the imaging software and described by dot area percentage. Random patterns of microscopic spots can also be created by software and perform the same function. The visual result is described as tone value percentage.

Tone values of conventional inks are measured as Dot Area or Dot Gain. Typical errors occurring in tone patches may cause the tone to be too dark, often caused by smearing or spreading of the dots. Colors or shades may be distorted, causing overall color casts or other undesired effects. Tone values of fluorescent inks behave in a similar fashion. The Intensity of the signal will be too low, and when used in conjunction with colored inks, color shifts or other undesirable effects will be evident.

The Beta FLUO instrument measures color as perceived by the human eye, and can report differences between the approved image and the current production sample. The differences in Intensity and Fluorescent Color are calculated and displayed.

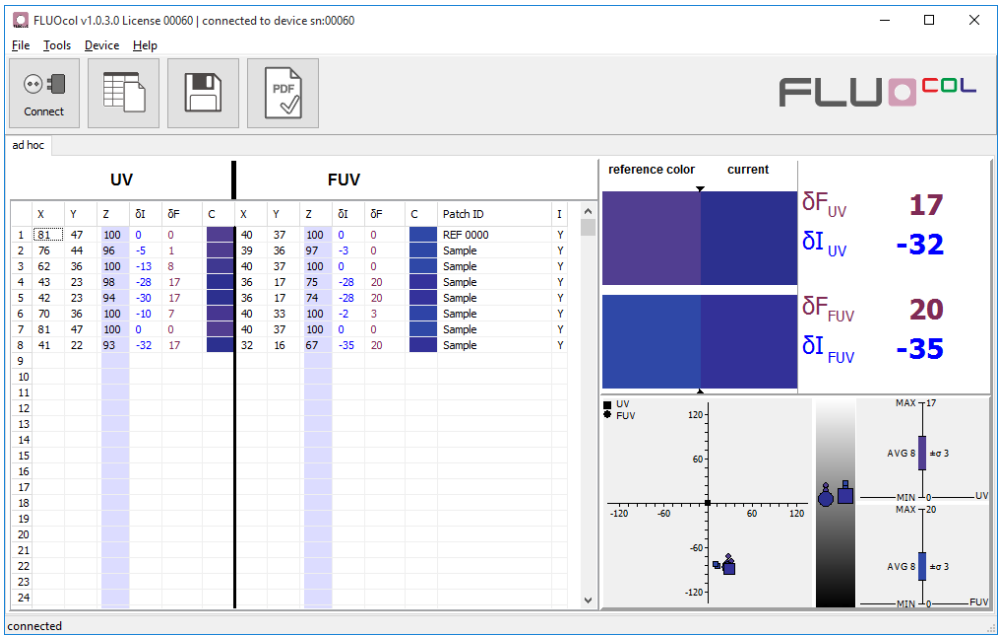

Fig. 4 Beta FLUOcol software display of Intensity differences of one ink in a production run
Data for near UV and Far UV measurements are collected in tabular form for export and further analysis.

Where color is an important authentication factor, the Beta FLUO and FLUOcol software display the measured color and the Reference Color along with the calculated Intensity and Fluorescent Color differences.

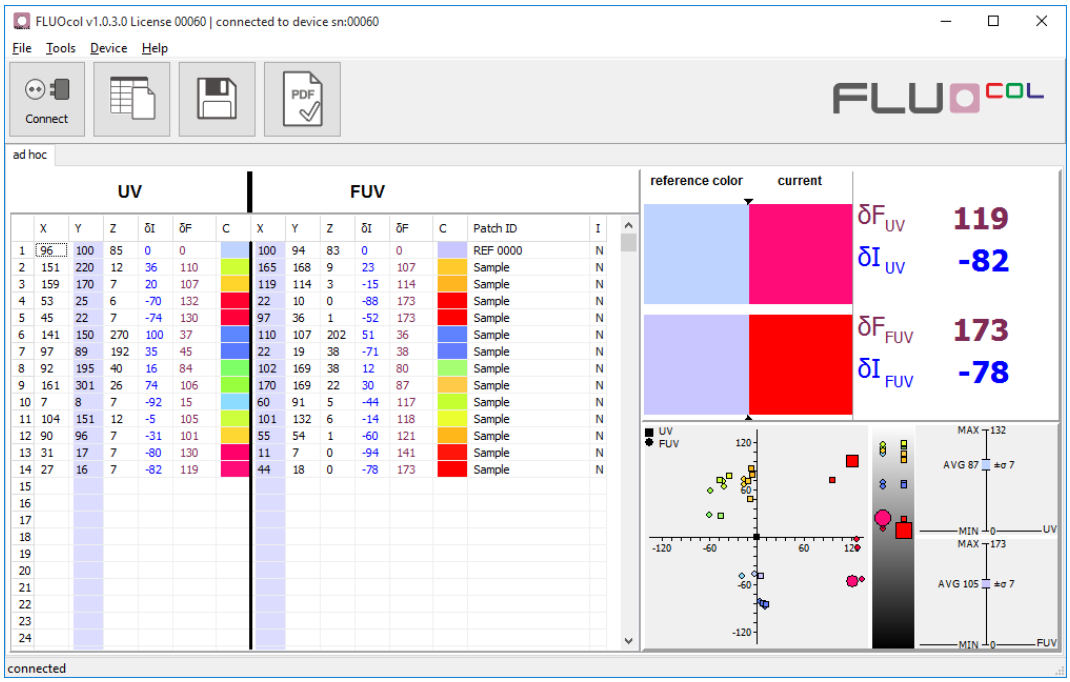

Fig. 5 **Beta FLUOcol software** display of Fluorescent Color Difference for multiple colors in a production run

Where the parameters of density and dot gain are easily measured, understood, and corrected by the press operator for a single conventional ink, the Beta FLUO Invisible UV Ink Spectrophotometer measures the Intensity and Intensity Difference of the production sample.

Where color hue is important the Fluorescent Color is measured and tristimuls vales and differences are calculated and displayed. This can be done with single inks or multicolor overprints used for sophisticared true-color rendering. With these measurement techniques the benefits of process control are brought to the Invisible UV Fluorescent Ink print production. The Beta FLUO device can reside in the print production area to give the press operator immediate feedback on a process that he cannot even see under normal room lighting

Beta FLUO Bullet Points

Invisible UV fluorescent inks can be used as part of a program;

- Protect a product against criminal activities such as piracy, counterfeiting and black market diversion

- FLUO brings the advantages of Process Control where none previously existed, measuring fluorescent intensity and colorimetery

- FLUO is used to prevent under-inking that might cause a read failure, prevent over-inking that wastes expensive ink

- FLUO measures the exact intensity and color of the fluorescence, helping to detect formulation errors or counterfeiting

- FLUO software collects the measurement data, generates color-accurate screen representations, and generates reports for documentation of the process

- Beta FLUO Invisible Ink Densitometer

- The Beta FLUO Invisible Ink Densitometer brings the benefits of process control to invisible UV fluorescent ink printing systems. Operating in both INTENSITY and COLORIMETRY modes, the quantity and quality of the ink image can quickly be verified.

- Clogged heads on inkjet systems or a bad anilox roll can reduce the amount of ink applied and the corresponding intensity of the fluorescent signal. Beta FLUO measures the signal and informs the operator.

- Incorrect ink formulation will change the colorimetric value of the fluorescent result. Graphical software shows the direction and magnitude of the color error, calculating delta E of the fluorescent signal.

- Beta FLUO is portable and rugged for the pressroom, accurate and repeatable for the QC lab.