

Addressing End User Requirements – UV Ink Jet Technology

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Abstract

As ink jet technology continues to develop, the demands for new ink technologies will grow in order to allow new end user applications to be satisfied. As ink jet printing systems continue to develop, they will provide increasingly higher quality while becoming wider and faster. The reliability demands on the ink jet ink will therefore be a key factor in determining the extent to which the market for this new technology will be developed within traditional print markets.

This paper will provide an overview of the developments in UV ink jet technology to satisfy these increasingly demanding end user needs. The paper will also provide examples of where UV inks are being used in the market place today and providing benefits previously undeliverable by conventional ink systems.

Introduction

The market for ink jet is today a multi-million dollar industry. As the market has developed, the demands placed on the technology to meet the requirements of new market applications continue to grow. The ink jet market may be segmented into three broad areas: SOHO (Sales Office/Home Office) Marking Systems and Commercial Graphics. Each segment has its own set of system and output requirements, but it is in the Commercial Graphics segment where the diversity of applications is the greatest.

The Commercial Graphics market consists of many sub-segments, many of which are dominated by traditional printing technologies. These include printing processes such as screen printing, flexography and lithography. These sub-segments include: Wide Format Display Graphics, Commercial printing and Publishing, Packaging, Decorative, and other miscellaneous industrial decoration applications. Although each of these segments has different characteristics, the key requirements of an ink jet system may be summarized under two headings – system reliability and output specification. Piezo drop-on-demand ink jet technology has become the dominant print head technology within both the established applications, such as wide format display graphics and developing markets such as packaging. This print head technology, while providing high resolution output, allows a high level of freedom of ink formulation. The freedom of ink technology is a key requirement given the diverse range of applications and output applications present within the commercial

graphics market segment. UV ink technology is emerging as a leading technology in the development of ink jet systems within this segment.

UV Inks

UV inks have been used within the traditional printing world for over twenty five years. The first UV screen printing ink, for example, was demonstrated at the FESPA exhibition in Milan in 1976. These inks contain no solvent and dry or cure by polymerization when exposed to UV radiation. This chemistry provides a basic set of characteristics which provides benefits for both the printing system and the output generated, as set out in Table I.

Table I. Features and Benefits of Conventional UV Inks

Feature	Benefit
Ink does not dry on the printing plate/screen	Excellent print reliability/high level of printing productivity
No solvent	No Volatile Organic Compounds (VOCs)
Excellent print film forming properties and adhesion	Wide range of print applications

These characteristics not only provide benefits for conventional printing systems but are also key requirements for ink jet systems.

The low viscosity requirements of ink jet inks require that UV jet inks consist mainly of UV monomeric material. The selection of these monomers is key to achieving the balance of properties required to meet the demands of both the ink jet system of the end use output. Ink requirements include – ink reactivity and cure speed, viscosity at the jetting temperature, odour and health and safety requirements. UV inks contain materials classed as irritants and exposure to these materials may also lead to sensitisation. Selection of materials that minimize these effects is a critical aspect of ink formulation.

End use output requirements differ widely from market to market. These different ink applications will require that different UV ink jet inks are formulated to meet these diverse needs. For example, the set of ink requirements for display graphics applications will differ significantly from the requirements for a packaging application, as set out in Table II.

Table II. Application Ink Requirements

Display Graphics	Packaging
Colour Gamut (Process colours, Spot colours)	Colour Gamut (Spot colour brand identity)
Substrate adhesion (Graphics materials)	Substrate adhesion (Packaging materials)
Scuff resistance	Product resistance (ink film resistance to packaged product)
Weathering/Lightfastness	Odour/Sensoric characteristics
Post print processing	Post print processing (e.g. sealing, sterilisation)

The diversity of ink market requirements will require different inks as ink jet printing systems are developed.

Although wide in their application, UV inks may not provide the optimal solution for all commercial graphics markets. In making judgments about ink jet inks, parallels may be drawn for the conventional printing industry where the use of UV inks has also developed rapidly over the last ten years. For example, some conventional print markets utilise oil based inks extensively, for example, news print. Such inks contain very low levels of volatile components and are therefore ideally suited to ink jet applications where their limited performance on the substrate is adequate for the application.

UV Ink Jet Printing Systems

The design of the ink jet printing system, as with inks, will be driven by the application and market requirements. One key issue will be the choice between scanning versus fixed print array configurations and their relationship to the print speed and print width. The presentation of the substrate, either web or sheet fed will also be a key factor. Speed requirements within many of the commercial graphics market segments will dictate that print heads are held stationary in an array to the width of the print. This design will demand a very high level of jetting reliability as lost jets will lead directly to print defects. Wider print widths will lead to more print heads being used and the reliability of these print heads over time, together with the frequency of failure and replacement, will also be key factors in the design of the printer. The enhanced jetting reliability of UV inks over water or solvent based inks, linked with their enhanced range of film properties when printed and cured compared to oil based inks, for example, leads to the conclusion that UV inks will be used in many of the commercial graphics markets.

Examples of UV ink jet printing systems used within the commercial graphics markets include those listed in Table III.

Table III. Examples of Commercial Graphics Ink Jet Printers

Printer	Market Segment
Vutek PressVu UV 180EC	Display Graphics (Flat bed)
Nur Tempo™	Display Graphics (Flat bed)
3M Printer 2500UV	Display Graphics (Flat bed)
Zund UVJet 215	Display Graphics (Flat bed)
Inca Digital Eagle 44	Display Graphics (Flat bed)
Durst Rho 160	Display Graphics (Flat bed)
Scitex Vision VeeJet	Display Graphics (Flat bed)
Chromas Argio™	Web labels
Digital Print Inc.	Web labels
Dotrix The.Factory™	Web Packaging/Decorative
Buskro UVC	Addressing

Conclusion

The commercial graphics market may be segmented into many diverse markets. Each sub-segment will place different demands on both the ink jet systems and the specification for the output generated. The reliability of the piezo print head as fixed print head array designs are developed to meet market speed requirements will be a key factor in determining the market success of ink jet in these new markets. As in the conventional print world, the print head stability and excellent film forming properties of UV inks will make them the ink system of choice for many applications. The diversity of application will however dictate that many UV ink formulations will be required, necessitating close co-operation between system builders and ink manufacturers.

Biography

John Law is General Manager of SunJet, a division of Sun Chemical focussed on development of the technology, manufacture, and distribution of ink jet inks. Since joining the Coates organization in 1980 he has gained extensive experience in both conventional and digital print markets.

John holds a Bachelor of Science Degree, with honours, in chemistry from the University of Bath and a Masters Degree in Business Administration (MBA) from Canterbury Business School at the University of Kent. A keen tennis player, John now resides with his much travelled family, after their latest move, in South West England.