Tonejet: Delivering Digital Printing to the Mass Market

Guy Newcombe, Tonejet Limited, Cambridgeshire, United Kingdom

Abstract

Tonejet technology and products have been created specifically to grow the multi-billion dollar opportunities that are derived from applying non-contact digital printing outside the office.

In this paper we shall explain how Tonejet delivers the combination of cost, quality and throughput that enables it to address the mass print markets. We shall also describe the technology and products that are being placed into the field and the way they are creating value for Tonejet's customers and partners.

Introduction

While digital printing has transformed the office and is making inroads into commercial printing it has yet to make a serious impact in the industrial sector. This is not because of a lack of demand, the benefits of short runs and mass customisation are well understood, but because until now no product has been able to deliver the combined requirements of cost, quality, throughput and reliability.

The arrival of Tonejet technology and products changes this picture. Companies are now able to print product that matches all their demands at a cost level that will, over time, enable them to move their entire production to digital.

Figure 1 illustrates the key point that Tonejet does not simply unlock the short run markets but actually enables a printer to reap all the benefits of digital print control and image variability at an attractive cost point across the complete run-length spectrum.

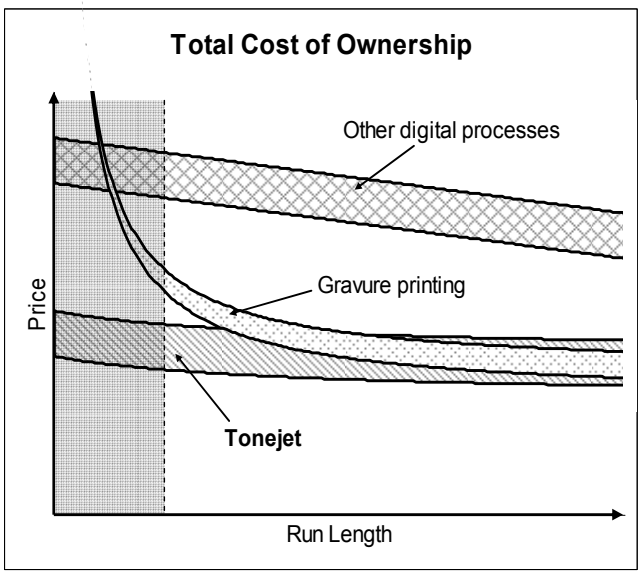

Figure 1: The variation of Total Cost of Ownership with run length for gravure, Tonejet and other digital processes.

Aside from its commercial demands, the industrial marketplace has very exacting standards in terms of colour match, durability and compatibility with its process chain. Specific industries, food packaging for example, have important additional requirements, which place additional constraints on the ink composition and curing mechanisms.

Tonejet has worked with many large players in these industries and in partnership with its delivery partners is able to offer a total digital solution.

The Tonejet Process

At the core of the Tonejet process lie the Tonejet head and the Tonejet ink.

Tonejet ink is a suspension of charged toner particles in an inert carrier, typically isopar.

The Tonejet head is an open structure through which the ink is flowed continuously. Ejection takes place not through nozzles, as is the case with inkjet processes, but from the array of Tonejet ejectors. Each one of these defines a well controlled meniscus shape so that with the application of an electric pulse the charged toner is drawn forwards into a concentrated jet that is propelled off the ejector out towards the substrate.

The Tonejet ejectors are shaped so that the meniscus response time is very short and importantly the dot size can be controlled continuously by modulating the pulse length. Our applications exploit this control within the image rendition algorithms to deliver superb digital print quality on virtually any substrate. Typically the head is driven with a pixel frequency of 24kHz delivering a stream of modulated dots that create high quality 600DPI greyscale images at 1m/s.

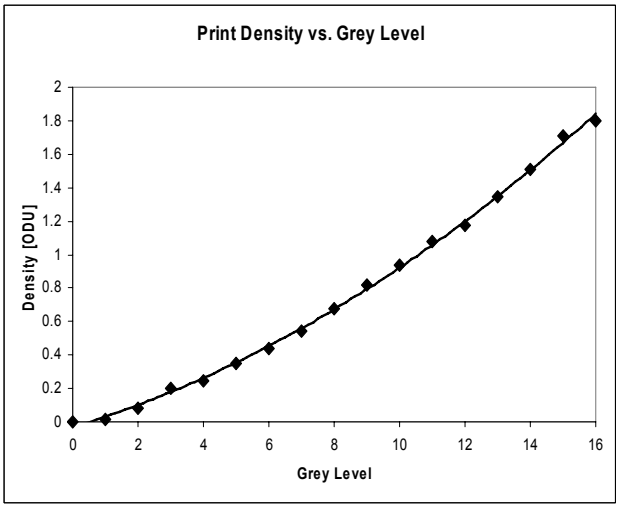

Figure 2: Continuous Greyscale Control at 1 m/s.

The features of the jet and printed dot follow from the nature of the electrostatic Tonejet ejection process. This delivers highly uniform, evenly spaced, lines on the print.

Figure 3 shows the process by which dilute ink is passed though the head and concentrated as it is ejected onto the printed product. The working ink is refilled with the concentrated formulation.

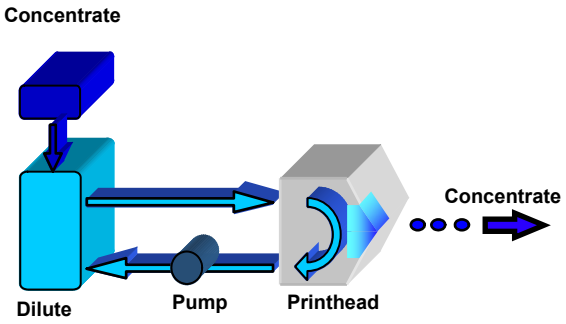

Figure 3: Dilute ink is continuously circulated around the printhead and concentrated at ejection by the Tonejet process.

Tonejet Ink

Because the Tonejet ink is not ejected through a nozzle there is great freedom to formulate it to suit the application and make it straightforward to manufacture in bulk.

Packaging applications, for example, demand white ink, typically TiO_2. This needs to be made up with the right particle size and pile height to deliver the required level of opacity. The flexibility of the Tonejet process enables us to give the formulation chemists the freedom they require to deliver the required result.

As the Tonejet ink is made with similar raw materials and processes to conventional inks it can be supplied to give all the features that the customers demand at a similar cost point.

The Tonejet Printhead

The Tonejet printhead is a precise comb-like array of ejectors and their associated electrodes that create the electrostatic ejection force on each jet. The head is made using a series of parallel processes that are well suited to scale up in terms of both head width and head number.

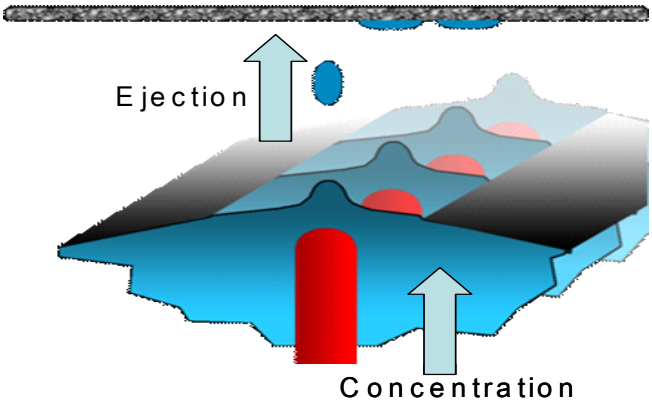

Figure 4: The Tonejet Printhead is simple and scalable.

Tonejet Image Quality

The Tonejet process puts down photographic quality images onto any substrate material. Its ability to emulate the finish produced by all the conventional printing processes with comparable costs means it can deliver a digital printing solution into a wide range of industries. Figure 5 illustrates some of these important applications.

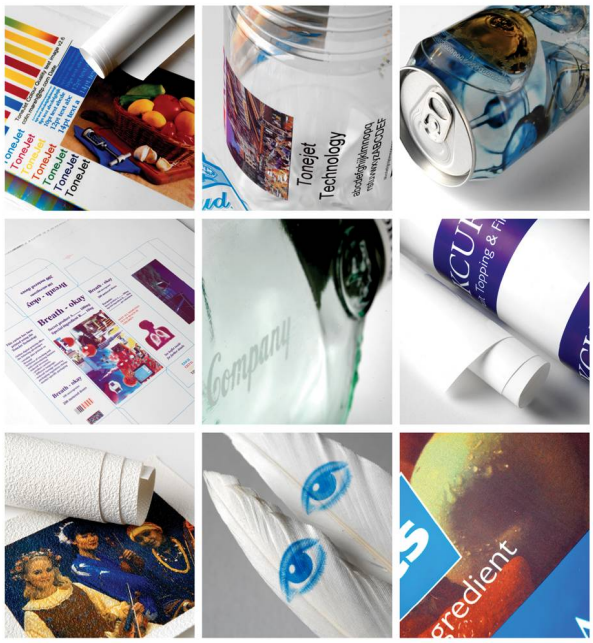

Figure 5: High quality Tonejet imaging for industrial applications.

Operational Reliability

In large scale printing operations reliability is essential.

Tonejet systems have been shown to operate continuously in single pass mode for hours at a time. This reliability comes from the openness of the ejection structure and our ability to continuously flow ink right past the ejector.

On-board maintenance features are built into the head and enable the high quality to be maintained with minimal down-time. Spot colours can also be exchanged promptly and with little wastage.

The 172mm Printhead

The 172mm printhead was developed to enable the printing of individual containers such as PET bottles and beverage cans.

Today it is the widest integral printhead being used for industrial applications and is being used as the building block for a major application that will revolutionise that industry.

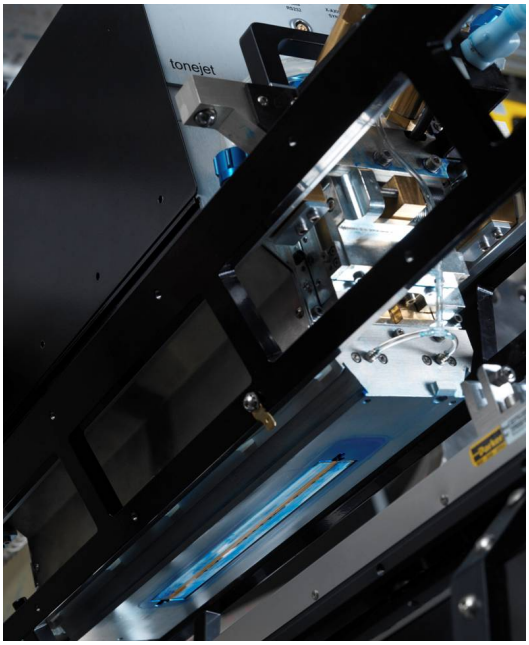

Figure 6: The 172mm Tonejet Printhead.

The Single Pass Tonejet Print Engine

The single pass Tonejet print engine is being developed to address web-based mass market applications. Based around a 640 channel 107mm printhead it will be scalable to presses of 1 metre width and beyond and enable customers to print the four process colours along with white and spot colours as required.

Single pass presses will be delivered through partnerships with specialised substrate handling partners into the customers' facilities**.**

Summary

The Tonejet print engine enables large scale industrial digital printing at a cost and quality that will enable customers to transfer all of their printing activity to Tonejet digital.

Product will shortly be delivered to our first customers and this will be followed by larger engines for printing on web based systems.

Biography

Guy Newcombe has been directly involved with the development of Tonejet technology and products since its early days, some ten years ago. In that time he has lead the Tonejet printhead, ink science and print performance programmes, along with a number of customer programmes. Today, Guy is part of the senior executive team of Tonejet with primary responsibility for the technology.

Guy is a graduate of Cambridge University and holds a PhD in Physics from the Cavendish Laboratory.