

Inkjet integration: Flexible and Sustainable

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Abstract:

Production inkjet is not new, but increasingly we are seeing it used in bespoke solutions that address many disparate manufacturing requirements. Importantly, this technology can also provide sustainable solutions.

Article:

Inkjet technology is creating and transforming many disparate applications, and it has the potential to do it sustainably. Increasingly, people and organizations are looking at new forms of print and industrial applications to meet sustainability demands.

Material deposition

Inkjet technologies support the deposition of a variety of substances that facilitate manufacturing processes. The types of substances can vary from water to solvent based on the specific inkjet technology and application. From an environmental standpoint, water-based ink is much more suited to the environment since it is comprised of naturally occurring substances and doesn't contain any of the toxic chemicals of its counterparts. Due to this, water-based ink is lower risk for printers, manufacturers, consumers, and the environment. In addition, because it's water soluble, no specialized chemicals are required for its clean up. This keeps potentially harmful substances out of our waste and water supply.

It is important to remember that, while the components of water-based ink are less harmful to the environment than those of solvent-based ink, the ultimate eco-footprint of water-based ink has as much to do with how it is handled, stored and cleaned as it does with the fact that it is much less toxic. Water-based ink is only eco-friendly when you use and dispose of it properly and completely, in a responsible manner. Even the best, most gentle industrial inks and cleaning products are still chemicals. Much of the long-term ecological damage of printing ink is a result of the alcohol in the fountain solution and solvent waste in clean-up, not the process or the chemicals.

Digital embellishment using inkjet technologies can now replace most analog solutions, in many different configurations designed to make it easy to implement in any facility. The digital solutions are timelier and more cost effective, since you no longer need to create physical plates and dyes, instead using digital print technology such as inkjet heads. The primary technologies used in digital embellishment are varnish deposition, usually using inkjet printheads or clear polymers. This can be used with various combinations of high build polymer dispersion metallic 'nano' particles in a varnish or polymer suspension and curable resin for creasing and embossing.



Commercial Print and Packaging

Consumer purchasing habits are shifting, and this is being reflected in shifts in print and printing process requirements. McKinsey & Company has been following the impact of historic and recent events on consumer purchasing performance and produced some interesting statistics. From 2017 to 2019, in the US, large brands of more than \$750 million in revenue lost volume at the rate of 1.5% a year, while small brands grew at a rate of 1.7% and private labels grew 4.3%. In fact, between 2018 and 2019, small brands grew four times faster than large brands. So, the shift away from big brands started before 2020 and the pandemic only accelerated it by forcing consumers out of their comfort zones. It is anticipated that the majority of consumers won't go back to the 'old ways' and will take a closer look at alternative purchasing channels and brands.

How printing and packaging are produced and what it is produced for plays an important role in this effort. New, more efficient digital print production technologies like the FUJIFILM 42K Printbar System are beginning to address these new market requirements and to add value to the printed applications with inkjet technologies that are reliable enough for print to be applied in new ways. Commercial print and packaging are leading this movement toward using environmentally and socially sustainable materials and processes to provide products and services. "This is good for the environment, and it puts more pressure on inkjet technology providers to offer inks with their jetting systems that can print on an expanding and rapidly changing set of materials," said Steve Atherton, Sr. Manager of Product Management and Marketing for Fujifilm Integrated Inkjet Solutions. "This isn't just about having the inks, but also having the experience to apply the right ink in the right situation."



Sustainable print manufacturing is often referred to as green printing, and it is about more than using recycled paper, it is about designing sustainable products that are also focused on use, reuse, production, and distribution. This new manufacturing mindset is based on creating and producing products that design out waste and pollution, keep products and materials in use, and regenerate natural systems. This focus known as a circular economy, and ultimately, moving to a circular economy, will enable us to help put the brakes on the rise in greenhouse gases.

Industrial

While inkjet technologies are transforming commercial print, and packaging applications, they are also extending to new areas of industrial applications. The industrial category of print is a catch-all for products that don't fit nicely into existing categories and is applied to many newer printing applications created as a result of the availability of inkjet technologies.

One of these applications is focused on the decorative print market also known as Décor. Décor is comprised of the furnishings and decoration of a room and the market includes:

Wallpaper

Flooring laminates

Furniture, panel laminates

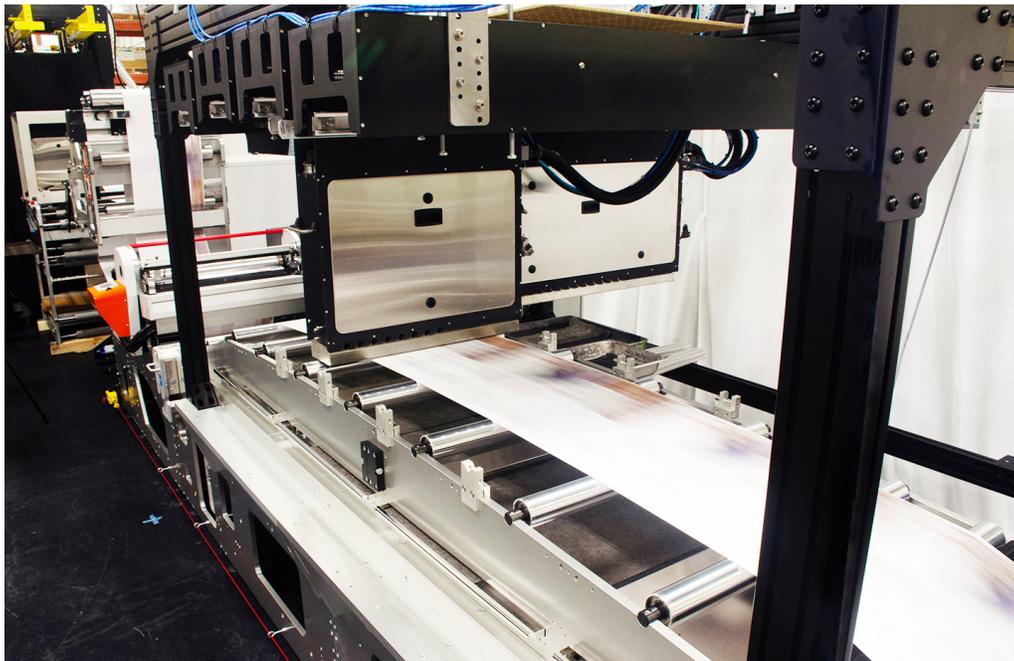
Wallcovering laminates

Metal Decoration

Direct printing of objects, such as panels, doors, and sundries (including glass screens and switches, knobs, buttons, and dials).

The decorative print market is growing, ultimately because of increasing global purchasing resources being used to improve living environments, while owners of businesses and public

buildings also wish to improve the public perception and approval of their premises. Trends driving this growth include keeping up with the latest fashion trends; the impetus to create an immersive brand experience in hospitality; an increase in new homes being built; and competition with traditional natural materials, such as wood flooring or stone tiles, using more sustainable inkjet-based production methods. Fujifilm for example has several products that cater to this market. The Fujifilm StarFire SG1024 industrial print bar system can be implemented as a standalone print solution or integrated into a manufacturing production line with a range of widths from 2.5 to 85 inches. It's Mini 4300 Series Industrial Inkjet Printbar System is small enough to be integrated into manufacturing lines for a variety of building-related products.



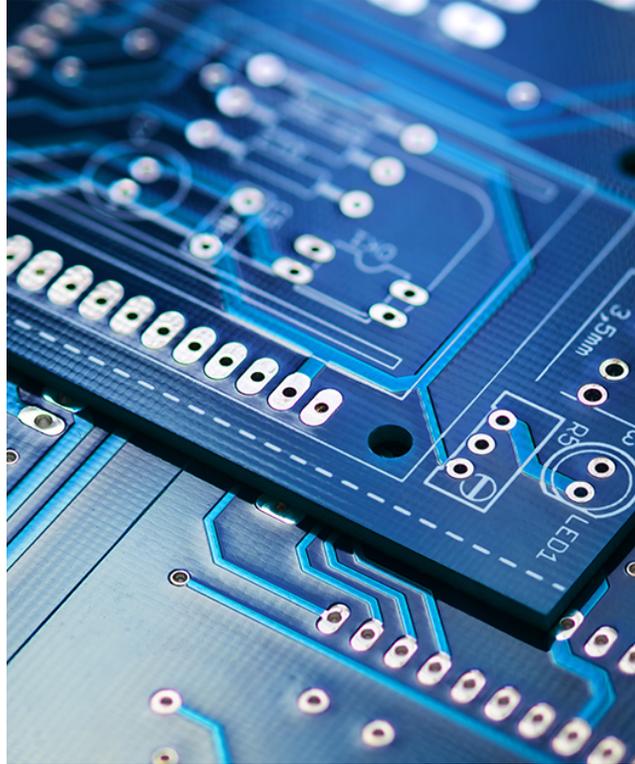
Textiles

Textile production is another industrial application for using sustainable inkjet technologies. The stages in the life cycle of a garment are creation of raw materials, production, shipping, use and disposal. Once the cotton is grown and harvested the production phase begins including spinning, knitting, and the wet processes of bleaching and dyeing. These processes use a great deal of water and energy, as well as commercial dyes and bleaches which are harmful pollutants and contaminate groundwater. While this phase may seem like the least environmentally detrimental part of the garment's life cycle, once you consider that each wash uses about 40 gallons of water per full load, combined with the energy used by dryers, you can begin to see that the environmental impact is significant. Printing on textiles for banners and soft signage has been around for a while using silkscreen and dye sublimation methods, however using inkjet technology to print directly on fabrics or garments provide a more sustainable solution. It also enables the introduction of mass customization of clothing and soft décor furnishings to support the shifting consumer trends.



Electronics

Inkjet printing technologies have become a new and disruptive method of manufacturing electronic components to produce a wide range of devices, including photovoltaic cells, solar panels, batteries, light sources, and sensors on thin, lightweight, and flexible substrates. Printing technologies are currently used to create electronic devices on different substrates. Printable electronics have enabled the production of electrical and electronic components to be used in conventional circuits on cost-effective, lightweight, and flexible materials, including flexible film, cloth, plastic, or paper. These have a low manufacturing cost, create flexible electronics, and use environmentally friendly technology on a wide range of substrates.



In traditional electronic manufacturing subtractive techniques use multiple production steps and toxic etching chemicals to remove unwanted photoresist layers and metals. Using inkjet technology, the same functional material can be selectively deposited only where it is needed on the substrate, via print heads. This is an additive process and it significantly reduces not only the number of manufacturing steps, but also the need for energy, time, consumables, and reduces the amount of waste. As a result, inkjet printing is an efficient, energy-saving and environmentally friendly manufacturing method for many electronics applications. Printed electronics are used in various industrial applications including batteries, packaging, consumer, sensor, displays and RFID. One of the main advantages of printable electronics are the efficient use of materials, which results in a significantly smaller amount of waste.

Just the beginning

As the awareness of available inkjet technologies increases and the potential benefits are recognized, we will see many new applications and uses. Many of these will include the integration of customized modular inkjet print technologies into existing manufacturing lines to facilitate more timely shifts in production demands.