

Advances in Energy Cure Ink Jet Radtech 2016

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Summary:

Inkjet printing using energy cure (EC) inks is expanding rapidly through the graphic arts and industrial printing markets. Printers in use number in the 10,000s, built by more than 40 graphic arts printer OEMs and at least 100 integrators for other industries. More than 40 companies manufacture UV cure inkjet ink, about half in North America, and several are nurturing EB as well. Ink distribution is world wide. Annual ink consumption is measured in thousands of tons, with a 1000 printers using ink supplied in gallon bottles or 5 gallon pails. Growth is double-digit and is projected to stay at that rate for some years.

Discussion:

Markets for UV ink include:

- graphic arts and commercial printing for billboards, banners, displays, advertising and more
- labels for retail, industrial, and commercial products
- 3-D or additive manufacturing for models and prototypes
- industrial printing such as flooring, laminate, furniture, wall-coverings, decoration, equipment instructions, and road-signs
- packaging especially corrugated cardboard ,folding carton, and some flexible packaging
- marking and coding which includes barcodes and serial numbers etc. on packages and products

Drivers for Digital Printing

The advantages of digital print are the same for the new markets as they have been for the mature:

- Minimal cost and time to change products
- Print on demand, and slash inventories
- Print the exact number needed, not an excess
- Economical short runs
- Support for regional selling
- Often much smaller footprint

EC inkjet is also durable, immediately dry, has bright colors and of great value for industrial applications, is non-contact.

Printing Technology

The core elements of the inkjet technology is well proven, reliable and becoming more cost effective – it has maturity. But it is not stagnant – continuous incremental improvement is being made to the printheads which increase reliability, reduce ink consumption and allow steadily faster operating speeds.

It has been the ability to assemble printheads in long arrays spanning the product that has been instrumental in opening the industrial printing market. That is the result of improvements in many areas – design, materials selection, manufacturing methodology, fluid handling and ink quality. But getting the experience has required markets, the first of which were with aqueous and solvent inks, for commercial and ceramic printing. Having a stationary print head with substrate moving continuously made possible replacement of analog inline printers. And the growth of the components business, printheads, ink handling, printer management hardware and software, has enabled the traditional OEMs in many industries, to assemble or integrate their own inkjet systems. This addresses major weaknesses of the traditional digital printing OEMs – inexperience with materials handling, and expertise with the applications. Their developments integrate seamlessly into major production lines, taking the substrate from the preceding process and passing it on in a fit state for the next and all subsequent unit operations.

Curing

Mercury UV lamps dominate the cure systems. LED is very popular and is preferred when it performs, because of its long life, consistent output and lower energy use. Obviously it enables UV printing on temperature sensitive substrates. It is exciting that EB cure for inkjet is a reality. It will be first adopted by the same people who use EB now, and for the same reasons. But there are other applications where it will prove superior and we look forward to seeing them come about.

Market Sector Activity

Inks for graphic arts. This market has a limited design base as there only a few machine configurations, a modest number of substrates, most with surfaces modified for the ink, and the various end use requirements are well known. Although there are increasing numbers of OEMs, many cover the full market for UV inks, and all ship machines that install quickly are ready to print.

In the early days of UV, few inks were compatible so a change required emptying and flushing the complete system. This was laborious, time consuming and wasteful. Additionally, the OEMs did not want to carry any more inks than necessary – many had shelf lives of less than a year. So, instead of producing a separate variant when an ink did not perform well, the practice with screen and flexography, for example, ink capability was expanded. This has been so successful that only about three variants are need for nearly all the graphic arts production. Formulating knowledge has spread so producing good ink is now comparatively straightforward, and less of an art.

Growth rates in graphic arts double digits. Competition from 3rd parties is increasing so although volume is going up, margins are getting tighter and prices are coming down. Nevertheless the OEMs have retained a substantial market share.

The major change in ink has been to match LED cure preferably with how inert and. We are watching emulsion UV cure inks. They promise greater economy but need drying to remove the water.

Inks for labels: A market sector seeing continued strong growth, with most label printing companies now offering digital print. The ink design base is again quite small: a limited number of substrates, a small number of printhead sources, fewer than a dozen OEMs in control, and a narrow range of applications. UV inks easily meet the durability requirements. The primary driver for formulation change is requests for low migration inks for food packaging. The ink channel is dominated by the OEMs and OEM ink manufacturers who have modest price pressure.

Inks for industrial applications: This sector is distinctly different from most others where digital printing has taken hold. There are dozens if not hundreds of applications: furniture, flooring, paneling, dashboards, gauges, equipment, logos, component decoration, instructions and more. A great deal of print is for parts rather than panels or roll stock, so material handling is core. Substrates are of any and all plastics, wood and wood composites, papers, textiles, metals, alloys, leather. They can be exposed in every environment, at all seasons everywhere around the world. Think of bulldozers! No limits to where they can be found

Industrial printers are usually in a manufacturing line, a series of process steps. The printer must take the material from the preceding step, printed it, and pass it to the next process with out delay or impediment. It should not be the rate determining step. As mentioned above, the availability of inkjet technology components or complete print engines has enabled the production line vendors to have their own assemblies they will integrate into the total production system.

The combinations of application, substrate and process mean nearly every job is distinct. And additional challenge for the formulator is that the other parts are predetermined – the substrate is chosen, the speed is set and there is no latitude with the performance. However the cost of changing ink supply is high so business once earned is usually retained.

Inks for packaging: Digital printing has entered packaging for applications where the traditional digital OEM machines have been functional. These are where there are limited substrate ranges, limited ink options and limited end-use environments. So large flatbed presses are used for cardboard boxes, while label and commercial roll to roll printers have application with folding carton. What would appear to be an excellent opportunity is flexible packaging (plastic bags and pouches). However, food packaging is the leading sector, and the others follow. And as food packaging is highly regulated with a very high penalty from demonstrated or perceived contamination, there is only a small volume of UV ink being used. Progress is being made from the determined efforts of committed chemical vendors and ink companies able to afford the development and testing effort. EB inkjet will be well poised here as its inks are widely used for direct food application

Packaging offers dozens of applications for cartons, boxes, bags, cans, bottles and pouches. Surfaces are flat or curved and there are many opportunities away from food. The range of substrates is extensive; most plastics and papers and synthetics. Durability demands are modest or low. Cans and bottles have exterior exposure, outdoor and all seasons. Paper-based packaging of course is less demanding but most have freezer to oven expectations. As much of the market is retail, print image appearance has high-value.

3-D and additive manufacturing: This is a relatively small volume but very high value market. It has required distinctly different formulating as the inks must substitute for solid polymers produced by extrusion molding, for example. OEMs control the ink channel and have limited the opportunities for third party formulators. There are applications that may be found but the investment requires an independent source of equipment. This is good business for those who have it.

Opportunities

Energy cure ink for inkjet is a high-growth market: rising tides lift all boats. Electron-beam cure will ensure penetration of the near food markets packaging, and counteract the migration perception of UV. It can take make large inroads into flexible packaging. The industrial market also has very large potential. In many instances new installations will be based on digital inkjet printers and not analog as the technology is sufficiently mature to be highly reliable. Nevertheless, industrial inks are at least semi-custom if not unique, application know-how is particularly valued, but providing the balance for the complete production system while meeting or bettering end use expectations is best.