

## IMAGING CHEMICALS AND MATERIALS: ELECTROPHOTOGRAPHY, THERMOGRAPHY, PHOTOGRAPHY

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This report analyzes the technology, markets, trends and opportunities, industry structure, and operating characteristics for electrophotography, thermography, and photography for the United States, Europe, Japan, and China.

Products made by imaging and printing technologies—from newspapers, magazines and books to photographs, films, transparencies, reports, currency, and credit cards—have become an important part of everyday life. Traditional or conventional imaging and printing technologies include offset lithography, gravure, flexography, and screen printing, as well as impact printing and silver halide photography. All these technologies are mature and have changed very little over the past few decades. A half-century ago, silver halide-based papers and films performed every task from image capture to document copying. Today, silver halide emulsion is still being used as an image-capture medium for visible light, infrared, and x-ray photography; however, the market for alternative technologies for image capture and hardcopy output—digital still cameras and photo-quality ink-jet printing—is rapidly increasing. Silver photography was replaced many years ago in document copying and in many other areas of black-and-white and color reproduction, in microfilm duplication, and in graphic arts. To serve the many markets in the imaging industry, a host of new imaging technologies has emerged over the last fifty years.

Traditional printing technologies, such as flexography, gravure, and offset lithography, and imaging technologies, such as silver halide photography, will be around for many more years. There are no technologies on the horizon capable of competing with offset lithography or flexography for doing large-run printing (millions of prints) at the same cost, speed, quality, and reliability. Therefore, newspaper printing will continue to use this technology until well into the twenty-first century. Similarly, silver halide photography will remain the dominant photographic technology—for image output, not for image capture—for the medium term because of its unsurpassed combination of image quality, archivability, and cost per print.

Imaging technologies are facing an ongoing change from analog to digital processes in many applications and markets. At the beginning of the 1990s, monochrome laser printers started to replace impact printers, such as typewriters and matrix printers, in the home and office environment, and were followed shortly by color ink-jet printers. The installed base of monochrome laser printers has reached a plateau, and so have multifunction printers (MFPs) combining scan, fax, and print devices, as well as cheaper and smaller electrophotographic (EP) color printers. Analog copiers have been replaced by digital copiers that can be linked to networks. Diazo printing for the duplication of engineering drawings has been replaced during the same period by large-format EP laser printers, electrostatic plotters, or ink-jet printers. With the increased demand of customized, short-run print jobs, offset printing is being increasingly challenged by digital EP printing presses.

Thermal printing technology offers a competitive mix of print quality and resolution, print speed, mechanical reliability and simplicity, and monochrome and multicolor printing. Thermal papers are produced in a wide variety of grammages and they can be processed with top and back coatings, laminated and converted with self-adhesive layers, and finished with integrated security features such as watermarks, UV fibers, or color-centered materials. At the end of the 1980s there was a boom in demand for thermal fax papers, but it was brought to an end by the emergence of laser and ink-jet fax machines in the 1990s. By 1992, fax paper consumption had peaked, but non-fax applications have compensated for the decline in thermal paper demand, including the development of new applications and markets such as tag, ticket, and label.

Today, thermal printing technology dominates those markets, and is showing steady growth and diversity. Point-of-sales is also an ever-growing market for thermal printing. Applications include bank statements, car park tickets, receipts from credit card payments in restaurants, hotels and supermarkets, and tickets for lottery, travel, leisure, and sports events. The operation of these printers can be unattended at locations such as gasoline pumps, highway tolls, or bus ticketing. The main uses in manufacturing applications are product labeling, inventory control, tracking, shipping and receiving, and maintaining of work in progress. Warehousing, transportation, and ticketing are also major application areas. Airline luggage tags and boarding passes as well as medical charts have also become interesting markets for the thermal printing industry.

The tremendous success of digital photography and the downfall of analog photography and the silver halide film business has led to a major change in the structure of the imaging and printing industry. The traditional photo film market has drastically declined over recent years. Unable to grow their digital businesses as fast as their conventional silver halide businesses declined, Eastman Kodak, Agfa-Gevaert, FUJIFILM, Konica Minolta, and Ilford Photo suffered huge losses and have struggled to find solutions for recovery and survival. As these photo companies needed to migrate capital quickly out of the declining conventional photo industry and into digital-imaging technologies, each did so with a different strategy. Most new activities of these companies have been related to ink-jet technology.

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