Proven Digital Output Products Leveraged from Robust Technology Platforms

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Abstract

Kodak Alaris leverages a number of technology platforms to create a broad range of digital output products. We are able to rapidly commercialize products to meet specific customer requirements, while at the same time serving a wide range of customer applications from a common platform. This advantage is enabled by a clear understanding of individual market requirements combined with a very responsive mechanism for custom product tuning to meet specific customer preferences around the globe. As a global manufacturer and marketer of a broad portfolio of photographic media the ability to efficiently localize products from a common platform is an important aspect of leveraging R&D and manufacturing scale while uniquely serving the needs of a given geographic market. Technology platforms that demonstrate this leverage include the KODAK PROFESSIONAL ENDURA Premier Media's family of silver halide technology, the formulation of professional grade photographic paper base, KODAK ESTAR base support technology, and a deep and continually evolving understanding in imaging science. This paper will discuss the products that have benefitted from these technology platforms and helped advance the photo fulfillment industry.

Introduction

Kodak Alaris is a technology leader in the development and advancement of color paper and display materials. This includes leadership positions in silver halide emulsion and image dye technology and photographic paper base technologies that set the standard for the true look and feel of a photograph. The company also uses a film base technology, a PET support, which is used in commercial transparent display materials. We leverage over 50 years of color image science technology experience to optimize final output quality from any capture source. This legacy has resulted in the commercialization of technology platforms that are being used today to create a wide range of digital output products. We follow a rigorous process during technology development that allows for rapid commercialization with products that can be tuned to meet specific customer requirements, while at the same time serving a wide range of customer applications from a common platform. This includes a very responsive mechanism for custom product "tuning" to meet world-wide regional customer preferences. As a global manufacturer and seller of a broad portfolio of photographic media this is an important aspect of leveraging R&D and manufacturing scale while uniquely serving the needs of a given geographic market.

Platform Silver Halide Technology

Silver halide technology impacts many important quality attributes of photographic materials. Specific attributes related to ENDURA Premier Paper have been previously discussed [1], and a more general discussion of silver halide technology will take place in this paper. A key attribute of silver halide technology contributing to pleasing image quality is the "smooth continuous tone" image formed from dye clouds as opposed to half-tone dots used in other forms of printing. ENDURA Media set the standard long ago and continue to lead in overall image quality today. This makes silver halide technology the gold standard for professional portraiture, where the imaging science technology is delivered within the paper, not applied to the top of the paper support. Advances in silver halide emulsion and dye technology have provided continuous improvements in flesh reproduction and the flesh to neutral relationship. For decades, professional labs and photographers, recognized the importance of flesh reproduction. Flesh to neutral defines the relationship between flesh tone and the neutrality of highlights, mid-tones, and shadows. Details in both highlights and shadows are also critical for professional photographers, both in the image capture as well as the output print. Consider capturing the intricate details in the bride's wedding gown in the same photograph as the groom's black tuxedo. Recent advances in Kodak Alaris' silver halide technology provides a softer, lower contrast lower scale to preserve highlight details combined with a higher contrast upper scale and maximum density (D-max) to allow the digital printer to reproduce subtle details in the shadow areas.

Color reproduction is also a critical attribute that's been improved with silver halide dye technology advances. Accurate color reproduction with a large color gamut provides important benefits to both commercial and portrait social labs. Portrait social labs need accurate color reproduction so that subtle pastel colors of subject elements such as bridesmaids' gowns are the correct color. Commercial labs need to accurately reproduce their clients' trademark colors and the saturated colors of their clients' products. Dye technology can also have an impact on illuminate sensitivity. Depending on the colorants used in other digital printing technologies, sensitivity to viewing illuminants, for example, daylight, tungsten lights, or fluorescent lights, can be quite high. That is, a print may have excellent color reproduction and flesh tone characteristics under daylight illumination, but look quite

different when viewed under tungsten illumination. Advanced dye technology in Kodak Alaris silver halide products meets the needs of high color saturation and excellent color and flesh reproduction while at the same time having excellent color fidelity under a variety of real world lighting conditions. This advanced dye technology puts KODAK PROFESSIONAL ENDURA Premier Media in the forefront in terms of image permanence. Since their introduction in 2002, dye technology has delivered double the dark stability performance for KODAK PROFESSIONAL ENDURA Premier Papers in comparison to its nearest silver halide competitor. The papers are also highly stable to light in consumer home display conditions, and because of the gelatin matrix that holds the dye molecules, the products are extremely robust to humidity and other atmospheric pollutants. Detailed permanence information was presented in an earlier paper [1], and detailed information on permanence testing and the international standards (ISO) that are used are available [2-4].

Platform Paper Support Technology

KODAK PROFESSIONAL ENDURA Premier Papers use a specialty paper core, surrounded by a plastic, polyethylene resin-coating on both sides of the paper (a white reflective layer above and a clear resin back side layer below). The paper core is a highly-refined specialty paper designed specifically for photographic applications. This includes neutral sizing to provide longevity, durability, and prevent yellowing over time, as well as resistance to penetration by the processing chemicals. The surrounding plastic resin makes the paper core essentially waterproof, blocking any absorption of processing chemicals from the top or bottom of the paper sheet. The white resin layer not only provides for bright whites, but acts as a reflector to bounce the light back through the imaging dyes, effectively providing double the impact from the dyes. This means greater color saturation and color reproduction benefits.

In Kodak Alaris silver halide papers, the support, gelatin, and emulsions form an integrated package to provide high quality, long lasting images. Designed and built specifically for photographic imaging, clearly this is a specialty paper with many unique qualities that function together to optimize the photographic performance and maximize the quality and longevity of an image. Using this paper technology platform across the world allows for different regional preferences to be met. For example slight modifications to paper core, polyethylene, and backprint design can be easily adjusted for regional customer preferences. See Figure 1.

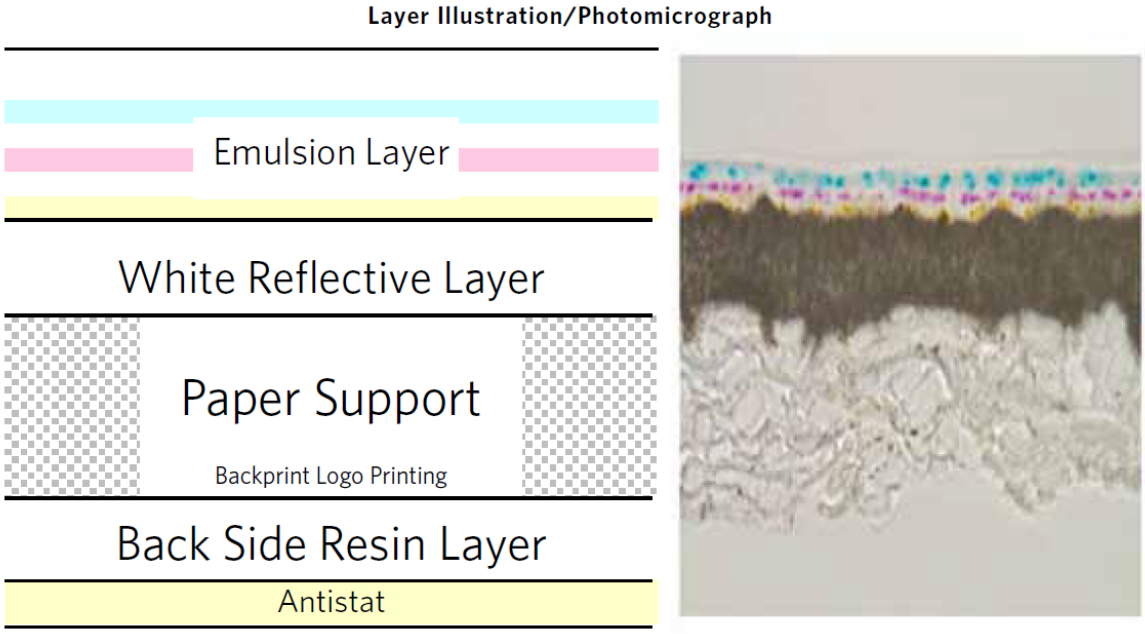

Figure 1: Layer structure of silver halide emulsions and paper base.

Making use of a common platform allows for the cost effective and efficient delivery of a broad portfolio of color photographic papers and display materials. KODAK PROFESSIONAL ENDURA Premier Metallic Paper support adds specialty film laminates to the base that provides customers a unique metallic appearance. The multi-laminate base additionally provides durability and tear-resistant. KODAK Photo Book Paper, our thinnest photographic paper is approximately 25% thinner than our KODAK PROFESSIONAL ENDURA Premier paper. This

paper is optimized for double sided photo albums where silver halide image quality is preferred. KODAK PROFESSIONAL ENDURA Premier Canvas Paper is another unique product derived from this common paper support platform. This surface is visually similar in texture to actual cotton canvas and provides a look of an oil painting. This paper offers efficiency and simplicity in production. With a single printing device the printing lab can complete the entire order. Because the same emulsions is used, an order that included a canvas print will match other lustre or glossy photographic prints that were produced. The need for specialty ink jet systems or secondary laminates is also eliminated. The ENDURA Premier silk surface paper is another "look" that customers are asking for and is enabled from the same paper support technology platform. These various surface options provide a range of offerings and variety while maintaining the consistent premium image quality characteristics of silver halide paper.

The flexible benefits of the paper support technology platform can also be applied to other imaging technologies. These technologies include papers used for printing in large commercial inkjet printers or electro photographic digital presses. Two paper products for digital presses are currently available from Kodak Alaris. The first is designed for liquid ink type presses and a second product developed exclusively for the standard dry toner type presses. KODAK PROFESSIONAL ENDURA EP-L Paper is specifically designed and certified for use with HP INDIGO Digital Presses. This paper brings high-quality photographic look and feel to digital press products that truly sets them apart. KODAK PROFESSIONAL ENDURA EP-D Paper is certified for use with the family of KODAK NEXPRESS Digital Production Color Presses. ENDURA EP-D Paper can also be used with other digital presses using dry ink/toner technology. With these elite papers, digital press products can now be positioned alongside the premium products made with ENDURA Premier Media to achieve a very similar look and feel between the two products. Similarly with commercial ink jet printers using UV-curable technologies, Kodak Alaris' platform approach can be leveraged to support this printing technology. The market demand is for a wide format photographic quality, non-back printed paper, as wide as 72-inch, with a matte surface texture to use for point-of- purchase, in-store displays, and advertising displays. The KODAK PROFESSIONAL UV-Curable Display Media can be used in all UV curable printer types, meeting the market demands up to the 72-inch wide format without any seams.

Platform paper technology also provides the capability for a variety of surface textures to be offered. These textures can be imparted across all our printing technology products. Along with the commonly used surface texture of glossy and matte surfaces there is the capability for unique or custom textures. This includes the silk, lustre, and canvas pattern surfaces. These products allow the labs to flexibly and efficiently offer new products to their end customers. The benefit of paper platform technology allows for consistent product performance, image quality look and feel and using ENDURA Premier Media ICC output profiles; color fidelity across all the paper textures, as well as the range of printing technologies that have been discussed.

Platform ESTAR (PET) Film Technology

KODAK ESTAR Base provides the PET, polyethylene terephthalate, film support for silver halide products. The film support is photographic quality and meets very high standards for clarity, lightness, uniformity, neutrality, and dimensional stability. Kodak Alaris utilizes this film support as a platform technology for our traditional silver halide display materials. Using the same film support, two products can be produced as either transparent or translucent appearing materials. To produce the translucent material the transparent film support has an additional white diffuser layer coated on it resulting in a translucent appearance. The Kodak Alaris products, KODAK PROFESSIONAL ENDURA Transparency Display Material and KODAK PROFESSIONAL ENDURA Clear Display Materials also demonstrates the flexibility provided by the use of platform film base technology, a special order product is also now available for niche applications. These applications require more light diffusion due to a higher intensity light source, so higher levels of the white diffuser are applied to meet these needs. Further extension of the film base platform allows for product offerings into UV- curable inkjet printing systems. KODAK PROFESSIONAL UV-Curable Display Film - Plus and KODAK PROFESSIONAL DURACLEAR Film / UV-Curable display media products include all the film base photographic quality attributes of our traditional silver halide materials and now provide these same benefits; clarity, lightness, uniformity, neutrality, and dimensional stability for commercial inkjet printers. As is the case with photographic paper, the benefits of film support platform technology allow for consistent product performance and image quality across the range of printing technologies for display applications.

Platform Imaging Science Technology

Kodak Alaris leverages its experience in photography, continuing to strengthen its strong foundation in image science to optimize images for the highest quality. Kodak Alaris has experience in developing algorithms that analyze and correct the exposure of images for optical printing and additional experience in digital printing. This experience is incorporated into Kodak Alaris' software products for digital imaging, while taking advantage of the nearly limitless degrees of freedom offered by these technologies to improve images in ways not possible in traditional optical printing. Through digital technology we have extended our knowledge by use of color management like ICC profiles and algorithms to optimize digital images for today's digital capture and output. Kodak Alaris' algorithms reflect exactly what customers consider important image qualities. Proper contrast, accurate flesh tones, overall color, and a variety of other image factors are technical attributes that reflect customer preferences. Through controlled tests that displayed critical image variables on a variety of common

subjects to customers, we have determined their preferences on ranked criteria, and designed algorithms to meet both their needs and those of professional labs.

We have built these algorithms into software applications like KODAK PROFESSIONAL Digital Print Production Software / DP2 that are designed to improve the productivity and output image quality for professional labs. With DP2, automatic image enhancements can be made in either batch or manual mode for contrast, tone scale, color balance, and density. Based on KODAK PERFECT TOUCH Technology, the algorithms used by DP2 are optimized specifically for use with professional images [5]. Kodak Alaris has been able to leverage its extensive knowledge of color science, digital technology, customer photo preferences, and professional lab requirements to design software that increases pro lab productivity by delivering ease-of-use and low makeover rates. This is accomplished by using sophisticated software algorithms. The use of custom ICC color profiles is critical in color management. This ensures optimum performance of a customer's output device and printing media to maximize image quality. This knowledge and expertise has allowed Kodak Alaris to build an image science technology platform that extends across all of our output media whether it's silver halide, ink jet, thermal dye transfer, or electrophotographic.

Conclusion

Kodak Alaris' technology platforms are being used today to create a wide range of digital output products. Because we have followed a rigorous process design during technology development, the digital products using these technologies can be commercialized rapidly, tuned to meet specific customer requirements, while at the same time are robust in customer applications. Use of platform technologies has resulted in leadership positions in the advancement of silver halide emulsion and image dye technology, photographic paper base technology, film base technology used in commercial transparent display materials. The technology platforms and commercialization processes that are being used today, and will be continued to be used in the future, support and expand digital product offerings as digital technology continues to evolve.

References

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Author Biography

Patrick Webber is a principal scientist at Kodak Alaris. He has worked at Kodak and Kodak Alaris now for over 30 years and has held a variety of positions in silver halide manufacturing and in research and development of color products. His primary focus for the last 20 years has been the development and commercialization of professional silver halide media products both for optical and digital use. Pat is the systems team leader for the design team developing color output media. Pat is also the world-wide product manager for color negative paper products.

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