

The Transformative Power of Pinning in Digital UV Printing

In the dynamic world of digital printing, UV curing technology is distinguished by its significant impact on print quality and efficiency. A critical but often overlooked component of this technology is the pinning process, which boosts the accuracy and sharpness of printed images. This article explores the importance of pinning in digital UV printing, highlighting its role in controlling ink spread and improving print quality. By examining the interactions among ink, light, and substrate, we'll demonstrate how pinning enriches the printing process, reaffirming its essential role in digital UV printing.

Digital UV Printing

Digital printing, (also known as inkjet printing), was one of the first printing technologies to adopt UV curing technology, a method used to dry or cure ink, coatings, adhesives, and resins. The special inks used in UV curing contain three types of components. Photoinitiators kick off the curing process under UV light; monomers and oligomers are molecules that bond together during curing to form polymers and the pigments provide color. When UV light is applied to these inks after printing, it triggers a chemical reaction called photopolymerization. This rapidly solidifies the ink, turning it from a liquid to a solid on the printing surface and enhancing the durability of the print.

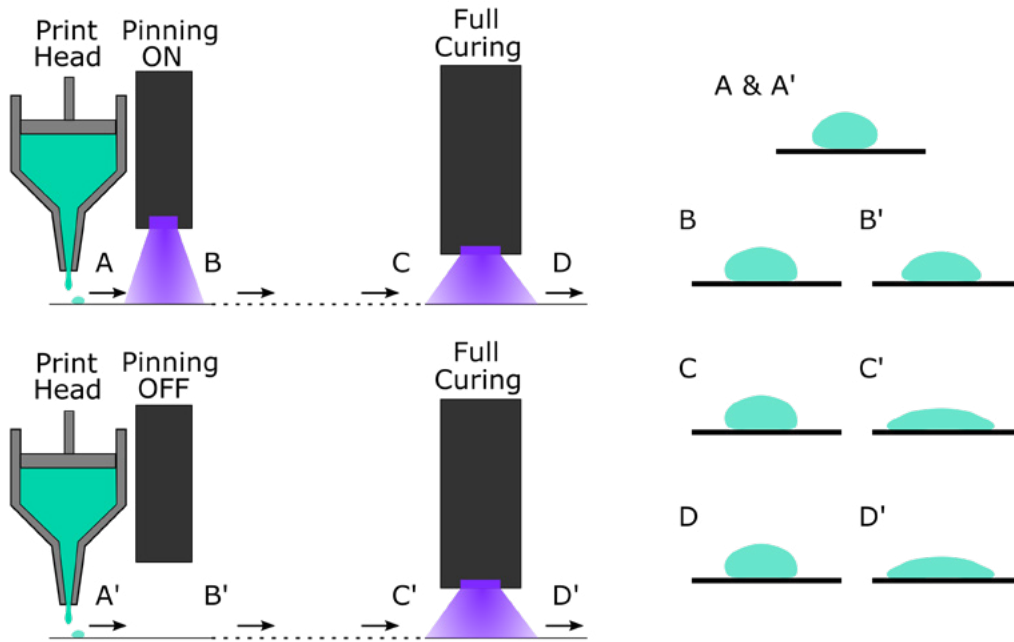
The Significance of Pinning in Digital UV Printing

Print quality can significantly suffer from ink dispersion on the substrate, resulting in blurred edges and smeared colors. Multiple factors, including substrate porosity and wettability, local temperature and ink viscosity, play a role in the spread of the ink droplets. Pinning is a practical approach to mitigate this issue as it efficiently restricts the spread of ink, thereby improving precision and clarity.

How Pinning Works

The output quality in digital UV printing depends on the printing and the curing steps. In the printing step, print heads containing monochrome ink or resin shoot tiny droplets of liquid ink or resin, respectively, onto the print substrate. These droplets start spreading rapidly on the print substrate, resulting in the aforementioned color smearing, affecting the overall quality. To finely control the behavior of printed droplets, digital UV printing uses low-dose UV lamps immediately after the print heads. These start curing the surface of the droplets and prevent them from spreading beyond the extent desired by the intended design. This process of partially curing the ink is called pinning. The UV lamps used for pinning are narrow by design and provide lower UV dosage than those used in full curing. Their relatively low UV output implies that pinning lamps do not need high-power cooling solutions and are often based on air-cooling or even passive cooling. Air cooling often causes vibrations, and the placement of pinning lamps close to the print heads can affect printing quality. Therefore, special precautions are taken to minimize vibrations caused by pinning lamps.

Figure: Effects of pinning on print quality



Hamamatsu Photonics' Pinning Solutions

Hamamatsu Photonics is a long-established provider of UV LED-based pinning solutions to the digital printing market. The UV-LED portfolio includes pinning lamps with a wide range of powers, from 1.5 W/cm² to 10W/cm² [2]. The pinning lamp size is kept small for easy integration while catering to the diverse needs of the customers, from speed to special effects. The light orientation, window size, and cooling solutions can be customized to meet system integration requirements. Hamamatsu also offers UV-LEDs with special optics like rod lens which enables longer working distance and minimizes reflection of UV light onto the print heads. Hamamatsu Photonics has developed proprietary air-cooling technology that can support full-curing UV-LED solutions with an irradiance of 24 W/cm² [3]. The capacity of Hamamatsu's air-cooling technology exceeds what is required for pinning lamps and contributes to the efficient design of our pinning lamps. Custom solutions with focusing optics that support long working distances and higher irradiance are also available upon request. For more information, please contact our sales team via info@hamamatsu.eu or visit www.hamamatsu.com.

Conclusion

Pinning is crucial for achieving high-quality prints. Pinning significantly raises the printing standard by enhancing output fidelity, ensuring durability, and improving clarity. Hamamatsu Photonics is the ideal partner in attaining superior-quality prints.

References

[1] Hamamatsu Photonics: www.hamamatsu.com/eu/en/product/light-and-radiation-sources/excimer-lamp-light-source/flat-excimer/application-printing-matte-finishing

[2] Hamamatsu Photonics: www.hamamatsu.com/eu/en/product/light-and-radiation-sources/uv-led-light-source/uv-led-light-source_linear-irradiation/product-lineup_uv-irradiance_descending-order

[3] Hamamatsu Photonics: www.hamamatsu.com/eu/en/product/light-and-radiation-sources/uv-led-light-source/uv-led-light-source_linear-irradiation/thomas