ElectroInk Charge Retention in the HP Indigo LEP Press

Thomas C. Anthony, Seongsik Chang, Quang Lam, and Omer Gila; Hewlett-Packard Laboratories; Palo Alto, CA

Abstract

ElectroInk experiences multiple transfers, some electrostatic and others mechanical, on its way from the ink can to printed image in an HP Indigo press. For example, in the binary ink developer (BID) [1], ink is electrostatically transferred from the developer roller to a metal cleaning roller and then removed from the cleaning roller and returned to the ink tank by mechanical action. The disposition of ink charge following transfer is critical to the performance of the press. Of particular interest are the timescale for ink charge decay following electrostatic transfer and the impact of mechanical transfer on ink charge. Both of these subjects will be addressed in this presentation.

Retention of ink particle charge in the time interval between field driven transfers is imperative for successful printing. In the LEP process, ink potentially can be discharged while on the photoconductor (PC), between development and transfer to the blanket. In a Series II press operating at a print speed of 1.2 m/s, residence time for ink on the photoconductor is up to 400 ms. Ink charge decay rate on the PC was measured by four electrostatic probes distributed around the circumference of the PC drum at distances of 15, 50, 250, and 500 mm from the active development station. A patch of black ink was transferred from the developer roller to the rotating, uncharged PC by engaging the negatively charged developer roller for 400 ms while simultaneously monitoring the four voltage probes until the ink and PC were fully discharged. Significant voltage decay occurred during the first few seconds, although the bulk of the voltage decayed with a time constant of several hundreds of seconds. Combining these data with additional measurements revealed three independent discharge processes: 1) ElectroInk discharge, 2) PC dark decay, and 3) PC charge depletion [2]. The latter two contributions were isolated from ink discharge by replacing ink with clean Imaging Oil and using the developer roller in the BID as a charge roller to charge the PC. Time constants for ink discharge were greater than 1 s, more than sufficient to ensure that ink charge is not dissipated before reaching the blanket. Charging agent was found to have a strong influence on charge decay rate.

Additional insight into ElectroInk behavior in the press was obtained by engaging the PC cleaning station during the discharge experiment. The cleaning station contains a wetted sponge roller and cleaning blade, both in direct contact with the PC, which removed all vestiges of ink solids. However, nearly all ink charge remained behind on the PC. As charged ink is scraped from the PC, large electric fields are developed between the growing mass of ink and the PC ground plane. Eventually the field exceeds either the ink charge director binding strength or the ink breakdown field, and ink charge is stripped from the ink particles and transferred to the PC surface. Off-press experiments supported this finding.

References

[1] Boaz Tagansky, "Ink Development in HP Indigo Digital Presses", Proc. of IS&T NIP 24: International Conference on Digital Printing Technologies, 799 (2008).

[2] S. Mishra and D. M. Pai, "Charge Depletion in Organic Photoreceptors", Proc. of IS&T NIP 12: International Conference on Digital Printing Technologies, 464 (1996).

Author Biography

Thomas Anthony received his Ph.D. in Materials Science and Engineering from Stanford University in 1984. During his first twenty years at HP Laboratories he worked as a technical contributor and project manager developing magnetic recording heads and memory devices (MRAM). He is currently a Distinguished Technologist in the Print and Content Delivery Lab, where his research focus is printing physics and materials.

