

# Combining laser engraving and UV-Inkjet printing for personalization of security documents

**Philip Kessler, Vincent Schneuwly, Fabrice Roubaty, Guillaume Guinot, Gilbert Gugler, Yoshinori Domae, iPrint Institute, HEIA-FR, HES-SO University of Applied Sciences and Arts Western Switzerland, Fribourg**  
**Mauro Costantini, Riccardo Pogliotti, Corrado Caizzi, Rudi Bressan, IXLA s.r.l, Romano Canavese, Italy**

## Abstract

Italian company IXLA partnered with the iPrint Institute to develop a ground-breaking solution for decentralised desktop colour inkjet printing within IXLA's laser engraving machines, addressing the demand for larger colour images and innovative security features in the personalisation of security documents. The project followed iPrint's 'digital manufacturing' process, including materials analysis, ink selection and extensive testing. The resulting 'XPrint' platform, which was unveiled at the TRUSTECH exhibition in Paris in November 2023, attracted considerable interest. The collaboration facilitated the in-house development of XPrint and helped position IXLA as a leading player in the personalisation of security documents. The future plans include delivery of first platforms in 2024, ongoing work to improve processes and a focus on developing new security features by combining laser and inkjet technologies. The aim is to exploit the full potential and synergies of both technologies for revolutionary, cost-effective and easily detectable security features.

## Introduction

While colour inkjet printing is already well-established on the market for centralised printing of security documents, there are only few solutions for decentralised desktop solutions. Italian company IXLA, which specialises in laser personalisation of security documents, partnered with the iPrint Institute to develop a solution integrating a relatively small inkjet printing system within IXLA's laser engraving machines.

The user-friendly system, aimed at non-specialist users, is a first in the security document personalisation market and is ready to meet the ever-changing demands of the market and the trend towards larger colour images, new innovative security features and digitalisation of security documents.

## Procedure

In this project, iPrint's 'digital manufacturing' process (material, ink, pre-treatment, printing, post-treatment, platform, product) was closely followed. The initial phase consisted of a thorough examination and analysis of the materials involved in the printing process. By taking into account material properties and printing requirements, precise ink specifications were defined. Leveraging iPrint's connections with the major companies in the ink market, a wide range of potential inks were identified and acquired. Extensive ink screening, based on material compatibility and specification compliance, enabled three ink candidates to be selected for further printing tests. Methods used to assess ink performance included adhesion, Taber abrasion resistance and UV fading tests.

In a next phase, A prototyping platform was developed and assembled to streamline testing and printing of the selected inks. The platform incorporated the key components for ink deposition and curing, allowing the ink candidates to be systematically

evaluated and validated. The printing process was carefully tested and optimised by fine-tuning various parameters from ink deposition to pre- and post-processing. One of the main focuses of research has been on the interaction between the laser and the inkjet technology. This phase was carried out in close cooperation between IXLA and iPrint to ensure a full knowledge transfer to IXLA.

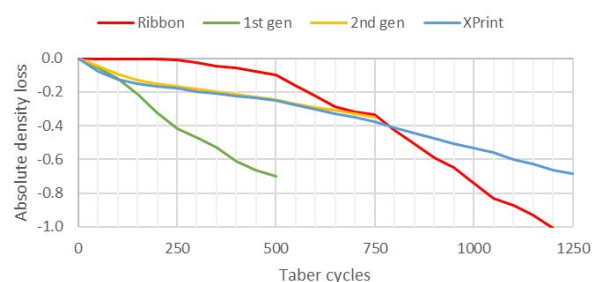


**Figure 1** Sample showing the combination of inkjet and laser technology

With targeted support from iPrint, IXLA used the knowledge gained to develop its own first platform, the 'XPrint'. A first model of this platform was installed at iPrint in October 2023. The primary focus is currently on long-term performance testing, optimisation of maintenance processes and the development and implementation of new features such as multi-pass printing or the integration of varnish.

## Results

The inks and printing parameters were subjected to evaluation through extensive testing according to high scientific standards. These tests were designed to validate the suitability of the selected inks and processes, specifically assessing critical parameters such as adhesion, abrasion resistance and UV fading resistance. The results not only contributed to a deep understanding of the process, but also played a key role in the development of the final product.



**Figure 2** Results of the abrasion resistance performance showing the improvement in performance resulting from the optimisation and a comparison with the performance of ribbon-printed samples.

The XPrint, the result of a one-year development process, was presented to a wide audience at the TRUSTECH exhibition in Paris in November 2023, generating an exceptional level of interest and response.



**Figure 3** XPrint platform with laser personalisation engine (right) and UV-inkjet engine (left)

Designed with a focus on user-oriented functionality, the XPrint represents a remarkable evolution in the field of security document personalisation. As the industry increasingly adopts larger colour images, integrates novel security features and undergoes digital transformation, the XPrint is positioned to play a leading role in shaping the future landscape of security document personalisation.

## Outlook

As a result of the high level of interest, IXLA has already received first orders for the system, which will be delivered in response to public tenders during the course of 2024. The installation will be closely followed by iPrint, as the field experience will help to further improve the processes and the reliability of the engines.

The key success factor of this project, the exceptionally close collaboration between the iPrint Institute and IXLA, and the extensive transfer of know-how, enabled the in-house development of the 'XPrint' platform and a major step forward for the IXLA company in the market of security document personalisation.

In the future of this long-term collaboration, iPrint will not only focus on helping IXLA improve the reliability of their processes and platforms. iPrint and IXLA also share the vision developing new, innovative security features. This will involve using cutting-edge security inks, and combining the two technologies laser and inkjet to enable revolutionary, low-cost, hard-to-counterfeit and easy-to-detect security features.

The intention is not to reduce the two technologies to their main characteristics - monochrome with laser and colour with inkjet - but to exploit their full potential and synergies.

## Author Biography

*Philip Kessler studied mechanical engineering, specialising in plastics technology and lightweight construction, at the University of Applied Sciences of Western Switzerland in Fribourg. He is currently writing his thesis as part of the Master of Advanced Studies in Industry 4.0 at the Zurich University of Applied Sciences. He has worked for the iPrint Institute for 5 years and is responsible for mechanical engineering, platform development and management of industrial projects*