

The Paper vs Polycarbonate Passport Debate

An ITW Security Division White Paper – March 2017



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Overview

By far one of the most significant changes in the Passport market in recent decades has been the move away from the more traditional paper based substrates to polycarbonate (PC). PC was first introduced into the Personal ID market in 1989 when Finland launched their new advanced substrate Driving License, this was soon followed up by the first PC Passport, again for Finland, in 1997. By 2008 10 different countries had chosen the new PC substrate for their Passports¹ moving to 30 by 2014². Now in 2017 a total of 35 countries use PC for their Passport datapages³.

Overall the global market for Personal ID is estimated to be worth approximately \$10,012 Million by 2021, increasing from \$9,037 Million in 2016. Within this figure the Passport market is the single largest element and this alone is expected to rise from around \$1,826 Million in 2016 to \$2,285 Million in 2021. Whilst the market growth rate has slowed from around 5.5% CAGR 2011-2016 to just an estimated 2.1% CAGR 2016-2021, the opportunity is still significant for new Passport solutions as countries seek to upgrade their existing Passport designs and in many cases, more towards the latest ePassports⁴.

Whilst PC has experienced rapid growth in recent years and is becoming the preferred material for the datapage in Passports, particularly following the US decision to switch to PC for its Passports which accounts for around 11% of global Passport production, the question remains which solution is best – paper or PC? This latest White Paper from ITW Security looks at both substrates and aims to advise on the solution that best meets government's and document issuer's individual requirements.



¹ Source: Gemalto – Polycarbonate & Identity Documents

http://www.securitydocumentworld.com/creo_files/upload/client_files/polycarbonatejuly20081.pdf

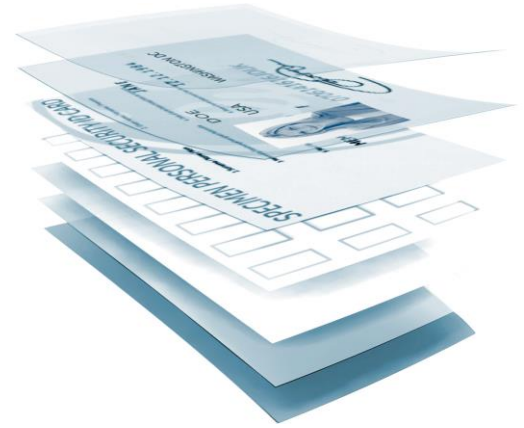
² Source: Gemalto – Polycarbonate for ID Documents http://www.academia.edu/7966334/Polycarbonate_for_ID_documents

³ Source: Smithers Pira – The Future of Personal ID to 2021

⁴ Source: Smithers Pira – The Future of Personal ID to 2021

What is Polycarbonate Material?

So, what is PC? PC is a type of thermoplastic material used for a variety of purposes such as indestructible eyeglasses and bullet proof glass. It is an extremely robust material with excellent moulding and thermoforming properties. A Passport datapage will contain multiple layers of PC material that are laminated together. During the lamination process the PC layers are fused together and the end-result is a finished material that cannot be delaminated which is of paramount importance to the security of the document.



Polycarbonate Advantages and Disadvantages

Durability

By far the main advantage of PC is durability which is said to exceed 10 years. The fusing together of many different layers means that the structure of the finished datapage is very robust and the individual layers cannot be delaminated or split after lamination. This is of crucial importance to most Governments as documents that cannot be split can also not be tampered with by traditional methods. The fraudulent use and alteration of identity and travel documents presents a threat to the security of countries and their citizens, the economy and global commerce, as it facilitates a wide range of crimes and terrorism⁵. It was based on this robustness that the Ukraine decided to move to their Passport datapage to PC back in 2015 citing the fact the fused layers formed a highly durable homogeneous construction that will not split⁶.

However, whilst the PC is in itself more durable the surface can be highly susceptible to marking and excessive scratching, which particularly in the Machine-Readable Zone (MRZ) area, may result in unreadable documents. In most cases the datapage is enclosed within the passport booklet however and this does help to keep marks and scratches to a minimum

⁵ <https://www.interpol.int/es/Criminalidad/Delincuencia-financiera/Counterfeit-currency-and-security-documents/Identity-and-travel-document-fraud>

⁶ ID & Secure Document News – March 2015 Edition.

Security

With so many different layers to a PC datapage there are multiple opportunities to insert different security features in different places, thus making the finished document much more difficult to alter or counterfeit. Would be counterfeiters no longer have single features or single layers to consider when they are attempting to alter a genuine document or make a counterfeit document.

A highly secure document that is difficult to alter or counterfeit is the goal of any Government. In addition to the number of features though, PC has opened the door to a new range of level one features including tactile, not previously seen in paper. These features, which include Multiple Laser Images (MLI), Changeable Laser Images (CLI) and Clear Windows, and are great examples of Level 1 features that border security and other Government officials need to be able to make almost instant immigration decisions. Uruguay opted for a PC datapage back in late 2016 based on the combination of durability and exactly these secure personalisation features as they saw them as a major step forwards in helping to prevent forgery and data alteration on their existing datapages⁷. On the flip side, paper based datapages have the ability to hold more security features overall whether in the paper or included in the overlamine that is used to protect the personalised data. Such features include security fibres, visible or invisible under various light sources (UVA, UVB, UVC), watermarks (single or multi tone), chemical sensitivity, dithered patterns, etc.



⁷ ID & Secure Document News – Eric Billiaert, Gemalto – September 2016 Edition.



Cost

When considering a move to a PC datapage from paper, cost is a major consideration for any government. PC material alone is expensive and certainly much more expensive than paper. Even when allowing for the additional consumable materials such as ink, ribbons and laminates required to protect a paper datapage, a PC datapage can still be substantially more expensive. To offset the increase in material costs, many governments are not only switching their Passport datapages to PC but also their other ID Cards and documents. Once a PC Passport line is installed Governments often quickly install other lines to produce PC National ID Cards and/or Driving Licenses/Healthcare/Voting Cards. They may even go one step further and seek to combine cards to reduce the overall cost impact. As an example, Senegal recently combined their National ID and Voting Card late in 2016⁸.

This trend towards multi-use ID's is becoming more prevalent, often sparked by increased raw material costs. Increased raw material and equipment costs cannot be underestimated though and will undoubtedly play a large role in choosing to remain with a paper based datapage; for example, both Philippines and Peru in 2016 launched a new Passport but chose to remain with a paper based substrate⁹.

Table 1: Paper vs Polycarbonate; Advantages and Disadvantages

Characteristic	Polycarbonate Advantages	Polycarbonate Disadvantages
Durability	10 Years +	Surface Easily Scratched
Security Features	Multiple Features/Multi Layers	Fewer Substrate Security Features
ID Photograph	Laser Engraved	Black & White Photos Can Be Altered
Structure	Non-Delaminable	PC Blends, Not Robust
Cost	Minimal Consumable Costs	PC Material Expensive

Characteristic	Paper Advantages	Paper Disadvantages
Durability	10 Years	Not As Durable As PC
Security Features	Wide Feature Range	Less Tactile Features
ID Photograph	Full Colour Photo	Need Fade Resistant Inks
Structure	Tampering Easily Detected	Layers Can Be Tampered/Separated
Cost	Final Cost Less Expensive Than PC	Consumable Costs High

⁸ ID & Secure Document News – November 2016 Edition

⁹ ID & Secure Document News – December 2016 & February 2016 Edition

PC Product Range Options

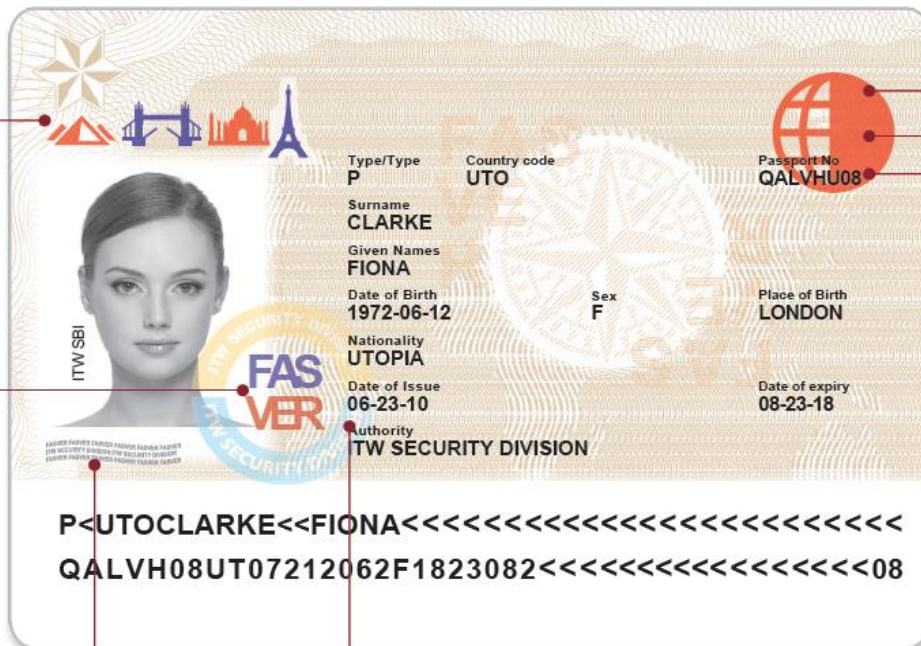
ITW Security's PC product range includes both PC Protek™ and HoloPC. PC Protek™ is a PC layer product containing secure printed features. The range of features is extensive and includes many unique patented features, Features include:

Thermochromic Ink

Images printed with thermochromic ink disappear when activated by heat, creating easily detected overt security features. Red reacts at 36°C; blue at 44°C.

Invisible UV Image

Invisible under normal lighting conditions, UV images become clearly visible when activated by UV light.



Thermochromic Ink

Metallic Effect

Metallic Effect

Brilliant colors and a mirror-like appearance give Fasver® metallic inks a highly desirable dual purpose—document security and stunning design. Colors include gold, silver, blue, red, and green.

OVTek®

OVTek® is an easily authenticated security feature, employing proprietary Fasver® technology to create a printed pattern composed of two separate graphics with colors that swap instantly based on the angle of view.

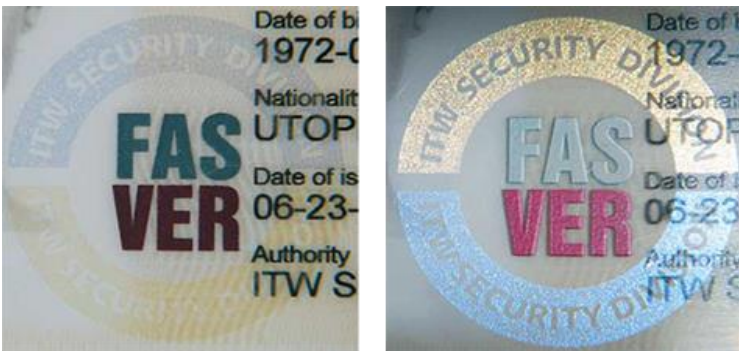
Hidden Image

Text and images hidden behind thermochromic print are revealed as the heat-activated thermochromic image disappears. Layering features in this manner increases visual appeal and thwarts counterfeiting attempts.



OVTek®

Ovtek® is a transparent colour shifting ink feature, or OVD, where patterns of two separate graphics are printed and whose colours swap instantly based on the viewing angle. The colours are bright and clear and yet biographical data can still be read through them and there are 6 different colour combinations available giving clients design choices and the inks are reactive to chemical, thermal and mechanical attacks. In addition, this feature is transparent to the laser used to impart the variable data into the PC.



Imagram®/Imaprotek®

Imagram® is another example of a transparent ink feature from ITW. Here a diffractive variable photographic image is printed with excellent colour rendering and like Ovtek® the finished effect is transparent ensuring that the variable biographical data underneath can be written by laser and clearly read. The feature is printed in such a way that any attempt to tamper with the inks will be exposed. Imaprotek® is another diffractive variable photographic image but visible only when exposed to UV light.



Metallization

Printing with highly reflective opaque inks helps accentuate other optically variable devices. Metallization cannot be reproduced using a printer, scanner or photocopier. This feature can be made in a full range of colors and font sizes.



Thermochromic Ink

Thermochromic inks are not new to the security market but ITW are now offering thermochromic inks in a wide range of colours, even specific colours when needed, for use on a wide range of substrates with up to a 10-year life. These inks are proven to withstand the high lamination temperatures and pressure of the PC lamination process and printable on a wide variety of substrates (PET, PVC, Paper, Synthetic Paper...)

There are also no restrictions on temperature ranges for any chosen colour. In addition, we are able to produce full polychromatic images as shown above in small or large areas in a range of temperatures from -20°C/-4°F to +80°C/176°F.



Achrogram™

Achrogram™ is colourless hologram or OVD with a flip feature. As the viewing angle changes the rainbow and matt white areas flip; rainbow becomes matt white and matt white rainbow. This is a feature that is very easy to verify but not easily to simulate or replicate with printing techniques. It is not produced on standard laser origination equipment rather a hybrid system that essentially builds structures without colour.



As with any secure hologram we would recommend a range of Level 1, 2 and 3 features. Level 1 features allow border control to inspect a document quickly at first glance without any additional tools. Achrogram™ along with Kinetic Movement, Fine Line Guilloche, Latent Images and Switch effects would be other good examples. For Level 2 we would suggest Microtext, Micro Imagery and Covert Laser Readable images. These would be verified if there was ever any doubt at the Level 1 stage. Level 3 features are required when Level 2 verification does not give a definitive yes or no answer to a genuine document and they often have to be verified in a laboratory environment. Examples would be Nanotext, Nano Imagery and Brick Matrix Manipulation. All of these features are available to view on our website www.itwsecuritydivision.com.

Paper Passport Range Options

Paper Passport substrates offer the facility to add a range of further security options and ITW Security's product range is both extensive and flexible in adapting to the small quantities required for Diplomatic and Seamen's Passports through to the larger National Passports of many large countries. The majority of products are thin film based which means coatings in the range of 1-2 microns are transferred from a carrier material on to the paper based datapage. With coatings, so thin, the alteration of data underneath is practically impossible without being immediately obvious. The range is also available in self-adhesive or heat sealable format to provide options with varied application needs, including Emergency Passport situations in decentralised embassies around the world.

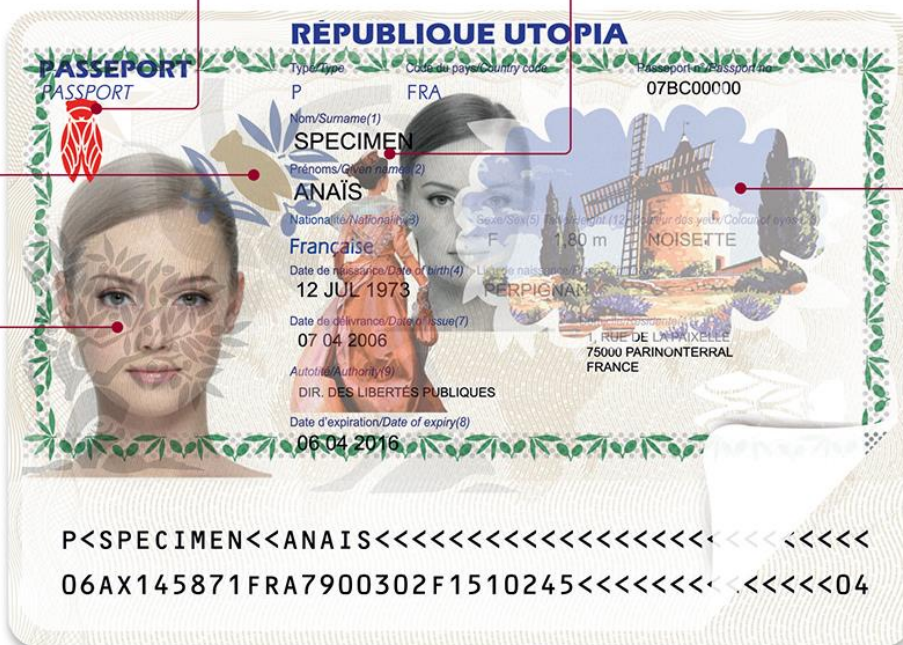
OVTek®

OVTek® is an easily authenticated security feature employing proprietary Fasver® technology to create a printed pattern composed of two separate graphics with colors that swap instantly based on the angle of view.

Thermochromic Printing

Imaprotek®

A polychromatic image derived from a photograph, using proprietary Fasver® technology, Imaprotek® is invisible under daylight yet vibrantly visible when exposed to UV light.



Matte/Shiny™

This patented Fasver® technology combines matte and shiny patterns in select laminate areas, making it impossible to recompose after an attempted forgery using an inauthentic plastic film.

Imagram®

Imagram® is a diffractive variable photographic image, created with proprietary Fasver® technology, which combines excellent color rendering with exceptional transparency for easy authentication and secure, unobtrusive placement over variable data.



Included within ITW Security's paper based Passport laminates is the full range of Holographic and Printed features already mentioned. ITW Security's features are universal so users don't need to decide upon a Passport datapage substrate based on the features offered. We are even able to offer tactile level 1 feature in our paper based range similar to those in PC.

Matt/Shiny

A unique feature where areas of the surface seal appear matte and other areas appear shiny. If any attempt was made to try and remove the seal, the frangible surface would split and the disturbances noticeable in the imagery/text.



Tactile Effect

Within our layers we can incorporate raised tactile patterns or designs that are easily identifiable by sight and by touch and cannot be reproduced using a printer, scanner or photocopier.



Summary

The decision whether to choose a paper based or PC based datapage for a Passport is not an easy one. There are advantages and disadvantages for both and the decision rests with the country alone and will link to the unique needs of each project. Whatever the decision, ITW Security Division has a range of products and an extensive range of security features available to deliver a Passport that is secure and above all resistant to alteration and counterfeiting. By using the latest substrates and technologies all parties can work to protect ourselves from the fraudulent use of ID documents which if unchecked threatens the security of countries, citizens, economy and global commerce through a wide range of crimes and terrorism¹⁰.

¹⁰ <https://www.interpol.int/es/Criminalidad/Delincuencia-financiera/Counterfeit-currency-and-security-documents/Identity-and-travel-document-fraud>

About Us – ITW Security Division

The ITW Security Division was formed in 2012 through the coming together of the management teams, technologies and resources of Covid®, Fasver® and Imagedata™. Leveraging the strengths of these brands, the ITW Security Division today offers the secure document market a single source supply for high security laminate documents and dye diffusion (D2T2) ribbons.

As an independently operated division of Illinois Tool Works Inc. (ITW), a Fortune 200 company, we have the financial resources necessary to continually invest in new technology, research and development. This global footprint and view has enabled us to supply products to more than half the world's countries from our secure facilities in the UK, France and USA.

At ITW Security Division we understand that the foundation for secure materials begins with highly secure manufacturing facilities. We manufacture products from start to finish in one of our secure facilities enabling us to meet the 'under-one-roof' production requirements demanded by many governments. Our products and technologies driven by our Covid® and Fasver® brands have developed a global reputation for highly advanced security solutions. Overt, covert and forensic security technologies are customised to the specific requirements of each document program to enable the widest combination of personalisation methods and substrates for passport and ID Card issuance worldwide. The companies within the security division include:

ITW Covid Security Group Inc was one of the world's first holographic and OVD manufacturers and now has over 25 years' experience. Located in New Jersey USA, the company is ISO14298 & NASPO (North American Security Products Organisation) accredited and manufactures all of its products under one roof, from holographic design and origination through to shim production, embossing, metallizing, laminating, die cutting, converting and packing.

ITW Imagedata is a global manufacturer of consumables for the Card industry located in the UK, specialising in the design and manufacture of D2T2 (dye sublimation) ribbons that we supply exclusively to OEM Card printers. The company is ISO 9001 and ISO 14001 certified.

Fasver® S.A.S.U. is a global leader in the design and production of security products for the protection of personal data on identity documents including Passports & ID Cards. Located in Montpellier, France, the company is ISO & Intergraf accredited and their unique authentication solutions have been protecting documents for over 25 years.