Innovation in the Design and Manufacture of Polycarbonate ID Credentials

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LaserCard brings over 20 years’ industry-leading experience in the use of polycarbonate to a wide range of secure ID credential products

The need for greater security in identity credentials has driven a number of significant changes in recent years. One of the more significant has been a higher level of investment, both in the credentials themselves and in the cardholder issuance systems. In turn, this has created demand for improved return on that investment, in the form of longer–lasting, more durable cards.

Modern ID documents are required to stand up to many types of stress, ranging from attempts at physical alteration, to years of inconsiderate handling in a variety of environments and weather conditions. Replacing damaged cards is costly. To deliver the most secure, durable and climate-resistant cards, the industry is increasingly turning to polycarbonate as the material of choice.

Introduction: Durability, Security and Tamper-Resistance

Polycarbonate has unique properties. When used in its pure form and not mixed with other plastics, the different layers of polycarbonate that make up the identity document fuse together to form a single, solid body. This preserves the integrity of the document, prevents disassembly and removal of authentic components for fraudulent use, and protects security features below the surface of the card, including irreversible laser-engraved personalized information.

In addition to supporting traditional security features such as offset security printing, optically variable or fluorescent inks, holograms and diffractive optically variable image devices, polycarbonate also supports highly fraud-resistant security features that are visible to the naked eye. These features, which are easily authenticated by relevant authorities without special tools or readers, include unalterable laser images, and laser-engraved personalized information.

Moreover, the durable nature of polycarbonate allows for the production of long-lifespan identity documents, which can last for ten years or more. It can accommodate one or more machine-readable technologies including contact, contactless or dual interface chips and RFID tags.

Polycarbonate has won the trust of governments around the world and today is increasingly used in the production of multiple advanced national identity card programs, national passport programs and national driving license programs.

Leading the Way in Polycarbonate Design

LaserCard Corporation committed to exploiting the advantages of polycarbonate more than 25 years ago, over a decade in advance of most of the card industry. The company’s expertise in polycarbonate evolved as a result of the development of its unique optical security media ID cards. Polycarbonate is an ideal support to optical security media because of its durability and optical properties. As a result, much of LaserCard’s engineering and manufacturing experience has been focused on innovation in the handling, printing and processing of polycarbonate.

In the early 1980’s the company first began to manufacture polycarbonate based optical security media cards for the U.S. permanent resident card or “Green Card” program. Many governments and national organizations followed the example of the Green Card, which has been described as ‘putting mass counterfeiters out of
business’ and has proven its durability over a life span of up to ten years and beyond. Today, LaserCard has delivered tens of millions of polycarbonate cards for programs ranging from citizen and government employee identity to major sporting event access control.

These decades of practical experience have given LaserCard unparalleled know-how in overcoming the challenges associated with processing polycarbonate, a very difficult material to work with. LaserCard is also using polycarbonate in the development of advanced multi-technology ID cards, leveraging its extensive engineering and manufacturing experience in the varied factors influencing the design, manufacture and delivery of cards. The company is now applying this knowledge to an even broader set of applications, including driver licenses and vehicle registration documents. As a result, the company’s expertise is in demand among industry peers and technology partners.

Qualities of Polycarbonate

Over time, the card industry has moved from paper-based documents to a wide range of materials, including polycarbonate, polyester, PETG, PVC, ABS, Teslin and Composites. Polycarbonates are a group of thermoplastic polymers that are easily molded, thermo-formed and non-delaminable. Polycarbonate has become one of the leading materials used in highly secure ID card programs and is rapidly becoming more widely deployed across a broader range of applications. This is largely because polycarbonate far surpasses other materials on three key attributes: durability, life expectancy and environmental stability. As can be seen in the illustration below, polycarbonate far exceeds the life span operational temperature range of even the most sophisticated PVC material or PVC composites used in card manufacturing.

Because of its durable, temperature-resistant and impact-resistant characteristics, polycarbonate holds up extraordinarily well in extreme weather and environmental conditions, making it preferable to other plastics or composite materials used in advanced ID cards.

In regions experiencing extreme heat and humidity, cards made of other plastic materials can easily melt or warp in the heat or direct sun, effectively ending the card’s useful life well before its designated expiration date. Polycarbonate, resistant to thermal stress, offers an alternative that can prolong card lifespan many times over. Governments in some areas that now reissue driver licenses every year can benefit economically and administratively by issuing polycarbonate-based documents that last up to ten years. When weighed against the cost of less expensive cards that need frequent replacement, polycarbonate cards may offer a long-term economic and administrative advantage.
Manufacturers of driver licenses and vehicle registration documents have historically used less expensive materials to meet the economic priorities of government agencies worldwide. However, the relative advantages of polycarbonate, as well as its cost effectiveness, make it a key to the future of this class of documents. As a leading exponent of polycarbonate card construction, LaserCard is bringing the benefits of this material to these applications and beyond.

Protecting RFID-enabled Chips

Polycarbonate also offers higher levels of protection to RFID tags laminated within the card’s structure. Polyester, although often used for many RFID cards, may delaminate relatively rapidly, thereby subjecting the RFID inlay to early failure. Through its pioneering work building multi-technology cards, LaserCard has developed special RFID inlay techniques on polycarbonate. Most WHTI (Western Hemisphere Travel Initiative)-compliant driver licenses are constructed of composite structures whereas LaserCard heat welds the antenna and chip directly into the structure of the polycarbonate card. The encapsulation of the chip entirely in polycarbonate, and thereby avoiding the stresses induced by the use of alternate composite encapsulation structures, protects it from damage.

Challenges in Polycarbonate Credential Manufacture

Polycarbonate, while desirable for ID card programs because of its durability and temperature-resistant characteristics, presents significant engineering and manufacturing challenges. Consistent production of polycarbonate cards is a difficult process requiring specialist expertise. LaserCard’s ongoing research and development has enabled it to overcome the most significant obstacles and extend the benefits of polycarbonate to a broad range of customers and variety of highly secure ID card programs.

One such challenge is the difficulty of die-cutting polycarbonate cards. Another is dye diffusion personalization where dyes must be specially formulated or the polycarbonate must be coated with a dye receptor layer or be laminated with a PVC overlay.

Today, while dye transfer printing still dominates the legacy-issued base of ID cards the industry is increasingly turning to laser engraving. With dye transfer, dyes can fade and images are frequently subject to blurring by dye migration resulting from exposure to high humidity or plasticizers in card wallets. Personalized information, which lives at the surface of the card, can be removed by nail polish remover, chemicals, abrasives or other means of fraudulent modification even when the images are protected by a durability patch.

The advantage of laser engraving by contrast is the durability of the image. Laser engraving produces a grayscale black and white image only, but that image is created by carbonization of the plastic and is invulnerable to effects of humidity, plasticizers or fading in sunlight. Further the laser engraved image is burned into the card body and cannot be removed, thus providing a higher level of resistance to fraudulent manipulation of the card. Also, the engraving can be tactile, non-tactile or a combination depending on engraving conditions and card structure.

In some applications, in order to obtain the fraud resistance of laser engraving combined with the availability of a color image of the card holder, a combination of laser engraving and dye transfer printing is used. Manufacturers must therefore be able to work effectively with polycarbonate to support both dye transfer and laser engraving in order to successfully meet market demands.
Polycarbonate in Major Programs

LaserCard has delivered numerous large-scale ID programs utilizing polycarbonate construction.

- **US Green Card**: more than 20 million cards have been issued since 1997; the next generation program launched in May 2010 is the world’s first implementation of optical security media and RFID technology;
- **Saudi Arabia National ID Card**: uncompromising document security and durability to overcome major counterfeiting issues
- **Cost Rica Foreign Resident Card**: counterfeit-proof credentials replace easily reproduced paper-based documentation
- **Italian National Police Force**: construction incorporates optical security media, contact and contactless chips within a single, secure and standards-compliant card design
- **India Vehicle Registration**: meets the most stringent durability requirements, as certified by independent laboratory testing supporting a 10-year lifetime
- **Republic of Angola National ID card**: counterfeit-resistant, tamperproof visual authentication and durability under extremes of climate
- **U.S. Department of Defense Automated Manifest System**: durable and reliable credentials for the world’s harshest conditions

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