

In-Mold Decorating with Pre-Printed Film Inserts

By Ann Marie Lentz, Technical Launch Manager, Serigraph Inc.

Applications for in-mold decorating with pre-printed film inserts continue to expand since technological improvements have made it an option for three-dimensional products with complex surfaces. IMD/IML cuts costs and boosts quality in uses from automobile interior components with compound curves to contoured control panels on appliances and in a wide variety of consumer products. Applications include almost all electronic devices, medical devices, sports equipment and toys, to name a few. People come in contact with in-mold decorated products everyday but few understand the technology, why it should be considered and how to incorporate it into a robust product design. Here is an inside look at what's happening with IMD/IML today.

Why Consider IMD/IML?

IMD/IML is an effective decorative option for parts with complex curves because the insert is formed to the shape of the finished product. IMD also has an advantage when the application requires consistently registered graphics, optically clear windows and the addition of conductive entities such as RFID, antennas and capacitive touch screens. By integrating the

graphics and conductive features into the molding process, secondary operations are eliminated and typically, scrap is greatly reduced. With pre-printed inserts in different solid colors, users also may avoid the need to purchase pre-colored resins. Altogether, cost savings from 5 to 40 percent can be realized.



The in-mold process often produces significantly less scrap than other methods such as adhesive labels because the decorated insert is shaped to fit precisely

into the mold, so the position or registration of the graphic is highly consistent and permanent. During or after secondary operations, labels sometimes shift on a part or collect dust at their edges, making them difficult to clean. IMD/IML eliminates those concerns because the decoration is fixed on or in the part and there are no edges. The technology creates a seamless appearance over 95 percent of the total surface area of the molded component when the printed construction ends within the body of the plastic housing, thus no exposed edges exist to trap dirt and delaminate from the plastic housing. This also enables the components to be cleaned with a wide variety of chemicals depending on resistance of the insert film chosen. Component cleaning is particularly important in medical

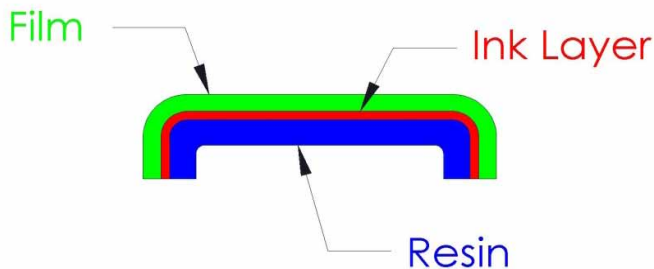


In-mold decorated glucose meters

applications where many antibacterial and antiviral cleaning solutions are used.

IMD/IML has given designers greater latitude than ever before by allowing designs with a wider variety of complex curves and shapes. It is possible to completely change the appearance of a part while continuing to use the same form, cut and mold tooling. These ‘interchangeable appliques’ make redesigning the part easier and more cost effective than ever before.

Insert molding also can be considered a green process since the molded component is recyclable when using similar stock to injection molding resin (for example polycarbonate stock to polycarbonate resin). This is especially true for components which formally included pressure sensitive labels. Additionally, printing is much cleaner and emits lower levels of volatile organic compounds when compared to other application methods such as spray coating technologies.



Typical second surface IMD/IML construction

Graphics can be printed on either the first or second surface of the insert’s film. The “first” surface is that which will be on the outside of the finished part. The “second” surface is where the insert’s printed image is viewed through the transparent film on which the image is printed. In this case, the molding resin bonds directly to the image and the surrounding film. The transparent film allows the use of clear or tinted windows in the insert. The durability, particularly of second-surface insert decoration, is well beyond that of other decorating methods because the graphics on the insert are permanently embedded in the product and are never exposed to its surrounding environment. The ‘untouchable’ second surface printed IMD/IML constructions accomplish better durability for abrasion and chemical resistance based upon the substrate selected in the application, thereby ensuring that the image will never rub off or be removed. This is useful for warning labels or reducing an OEM’s liability when PSA labels are removed.

Where to Begin – Matching Up the Materials

The IMD/IML design process begins with selecting a film that meets the required durability, flexibility, chemical resistance

and hardness properties. These requirements include specifications provided by the customer for their particular application. Without properly defined specifications, incorrect film and ink selection may result in later performance failures. The most appropriate sheet or film materials for printed inserts are those with higher surface energy that will allow stronger and more consistent ink bonding. These include polycarbonate, PET, acrylic, ABS, PVC and PS. However, success with some lower surface energy materials, as well as those that are self-lubricating, is limited due to inter-film adhesion issues. With proper pretreatment, PP and PE also have been successfully used in the in-mold process.

The most common molding resins used are polycarbonate, PET, SAN, PC/ABS, PVC, nylons, ABS, PS, acrylic, PP and PE. In general, the insert and backing resins do not have to be identical, but they must be compatible. If not, then a special heat-activated adhesive must be used to ensure inter-coat adhesion.

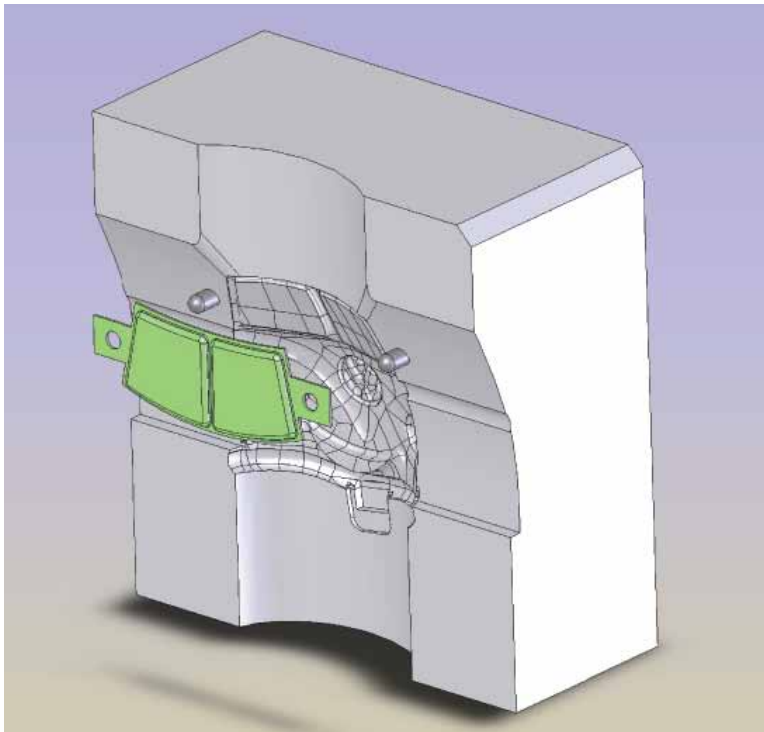
Ink selection is based upon the performance specifications. These can include opacity, transmissivity, IR and RF transparency, chemical resistance, elongation, adhesive strength, bright

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Insert in the molding tool

metallic graphics and conductivity requirements of the ink/film combination. Proprietary ink and coating systems have been developed to withstand the temperatures and elongation associated with forming and molding.

After printing, and in many cases, forming operations, the insert is diecut to fit the mold. The diecutting process can be automated depending upon the size of the part, the application and production volume. The insert then can be used as a flat or 3D overlay. Three dimensional forming involves the use of one (or a combination) of the following forming methods: vacuum, thermo, hydro or pressure. Proprietary elastic ink and coating systems have been developed to withstand the rigors of forming and molding.

In the molding process, the decorated insert is placed into the cavity or onto the core of an injection mold that has been designed for in-mold decorating. The desired molding resin is shot behind or over the insert, bonding its surface to the decorated insert and forming an integral finished part.

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Challenges

IMD/IML does have its challenges and limitations. It is less cost-effective if the decorated area is a small portion of the decorated surface. Up-front design considerations are of paramount importance for the process, including printing, forming tool, cutting tool and injection molding tool design. In particular, graphic locations may need to be printed distorted before the forming operation to allow the graphics to move into register during the forming process. While not recommended, some existing tools can be modified for IMD/IML. However, new tooling is almost always recommended.

With the correct design, film selection and engineering, IMD/IML can become the process of choice in many applications today. This process allows for cost effectiveness and a wide variety of aesthetic and functional designs. In addition, in-mold increases the ability to recycle many components, reducing the possibility of post-consumer waste and stress on landfills.

Pushing the Envelope

Serigraph is one company pushing the envelope when it comes to new applications for IMD/IML. Thin wall constructions used in the telecom, medical and computer industries are allowing the minimization of weight and space that the IMD/IML requires. Many times designers are looking to make their product lighter and smaller. With careful selection of inks, film and adhesive, this has been made a reality.

IMD/IML engineers have been able to drive cost out of the process by using flat appliqué when possible. With careful tool design, flat appliqué have been successfully molded into parts with a 90 degree turn. By using 2D appliqué, the cost of pre-forming the film is taken completely out of the equation.

Taking a closer look, the IMD/IML process brings quality, durability and visual aesthetics to products across a broad spectrum. It very well may be the best choice for making a product stand out from the crowd. ■

Serigraph is the leader in design and manufacture of graphic appliqué for In-Mold Decorating/ Labeling (IMD/IML). What differentiates Serigraph is its ability to insert mold/integrate the appliqué into a decorative or functional product. Serigraph can mold products in-house or provide turn-key molding. Implementing thousands of successful IMD projects, the company has the technical expertise, printing, tooling, molding technology, quality systems and global reach to deliver a wide range of applications, thereby offering a single-source solution and eliminating problems with fragmented supply chains. To learn more about flat or formed appliqué or a complete molded product, visit www.serigraph.com.

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