

# IMD Technology Applied to the Surface Decoration in Product Design

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**Abstract**—IMD Technology is developed to solve the shortages of the traditional surface decoration technology of plastic molding, and is the best new technology that substitutes for the plastic spray paint and electroplating processing now. It can reduce the follow-up injection processing. IMD technology is to put the pre-treated film with decorative illustrations, logos and color inlay on the injection mold cavity for spotting and injecting. Its classification include to IML, IMR and IMF technology. The material that IMD technology used is plastic. IMD technology processes are illustrated in this paper. Applications of IMD technology are mainly in the computer industry and in the communications industry. Other industries are medical equipment, cosmetics boxes, decorative boxes, toys, sports and recreation supplies. It is shown that IMD technology has brought a wildly innovation in product design. To promote and popularize it in the plastics industry can achieve energy saving and environmental protection significance.

**Keywords**- *IMD Technology; Surface Decoration; Pre-treated Film; Plastic; Product Design*

## I. INTRODUCTION

Almost every component of a product has some sort of surface process applied to it. Surface processes enhance the thermal, fatigue, friction, wear, corrosion or aesthetic qualities of the surface, leaving the bulk properties unchanged. The choice of a surface process depends on the

material to which it will be applied and the function it is to perform<sup>[1]</sup>. Due to its fine processing characteristics and the use of performance, plastic materials are widely used. The traditional plastic decorative techniques include painting, vacuum plating, gourd, hot stamping, pad printing, etc. But there are many drawbacks and limitations, such as high defective rate, poor printing ink abrasion resistance, long production period, especially not environmental protection<sup>[2-3]</sup>. IMD technology (In Mold Decoration) make the integration of injection molding and surface decoration, not only solve the above problem and reduce the subsequent processing process, but also brought significant innovation to product design.

IMD stands for In Mold Decoration. IMD Technology — Put the pre-treated film with decorative illustrations, logos and color inlay on the injection mold cavity for spotting and injecting<sup>[4-5]</sup>. Casting resin in the back of the film combines with the ink layer. Illustrations, logos and color of products place between the film and resin, so they will not be worn and chemical corrosion-resistant. So IMD technology is also named spraying-avoided technology. Because of its outstanding advantages, IMD technology has been applied in many different industries during the past few years, and it can be used in the panels of the automobile, communications, electronics, electrical appliances, instruments, apparatus, combining with decoration and function<sup>[6-8]</sup>.

## II. IMD TECHNOLOGY CLASSIFICATION

IMD Technology can be classified to IML, IMR and IMF technology<sup>[7-10]</sup> ..

IML stands for In Molding Label. It has been mainly used in packaging industry such as blowing plastic containers, shampoo bottles, bath bottles, cosmetic bottles, etc. It has also been mainly used in edible box containers such as ice-cream cups, plastic cups, etc. Besides, it has application in beer boxes, beach table & chairs, sports articles, etc. The technique is to put the labels printed and cut with PP & PET films inlay in mold cavity for injection molding, so it call IML. Because the graphic ink of the technology is exposed and the surface of decorative part is flat, the film does not need to mold.

IMR stands for In Molding Roller. The technique process is as below: Printing the release agent on the scroll-type PET film → printing the graphic ink-lay → printing adhesives → compounding die to inject → separating the die sinking films from printing ink. In addition, the technique can be completed by film conveying → waste film receiving → CCD positioning operation.

IMR Technology have many advantages and disadvantages, such as the whole roll of film could be series manufactured, not only patterns and characters are clear, but also the color is extremely bright, especially the effect of imitation plating is beyond compare; also it can not be decorated with 3D three-dimensional shape, and there is no protective film on the surface that the illustrations are easily drop off. The cost is too high because the films are purchased abroad. In addition, the new product development cycle is extremely long, and the cost is greatly high, the color of the patterns can not achieve a low-volume flexible Change as well.

IMF stands for IN Molding Film. The technique process is as: Printing the pattern on the film → film forming → film slitting → in mold tectorial membrane to inject.

The advantages of IMF are that it can be decorated with 3D three-dimensional shape, and the inks never wear, the membranes can print itself as well. Besides, patterns and textures can be freely designed. All in all, it has low-cost production.

IMD – Major system and flow chart are shown in Fig .1<sup>[9]</sup>.

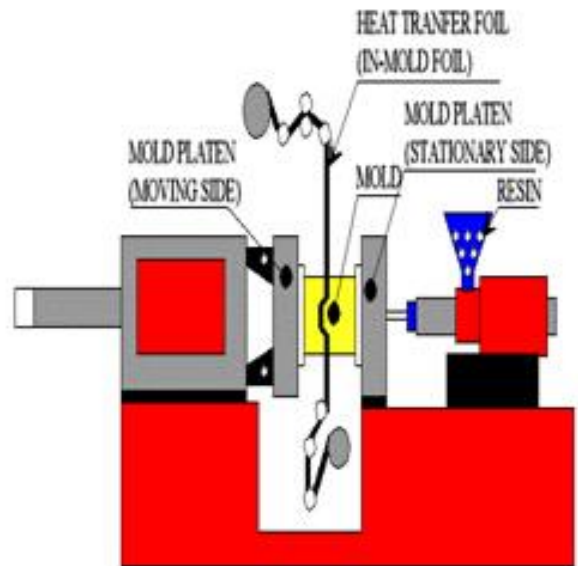


Figure 1. IMD – Major system and flow chart

Schematic process flow of IML is shown in Fig .2<sup>[10]</sup>. Step 1 is the special hot stamping foil laminated onto a vacuum formable backing foil. Backing foil material is ABS. Step 2 is the three dimensional vacuum forming under influence of temperature, vacuum and/or overpressure. Step 3 is the die cutting of the precise shape of the inserts. Step 4 is the Insertion of the Insert into the mold manually or by robot. Step 5 is the moulding process with resin compatible to the backing foil. Step6 is the part handling after molding manually or by robot.

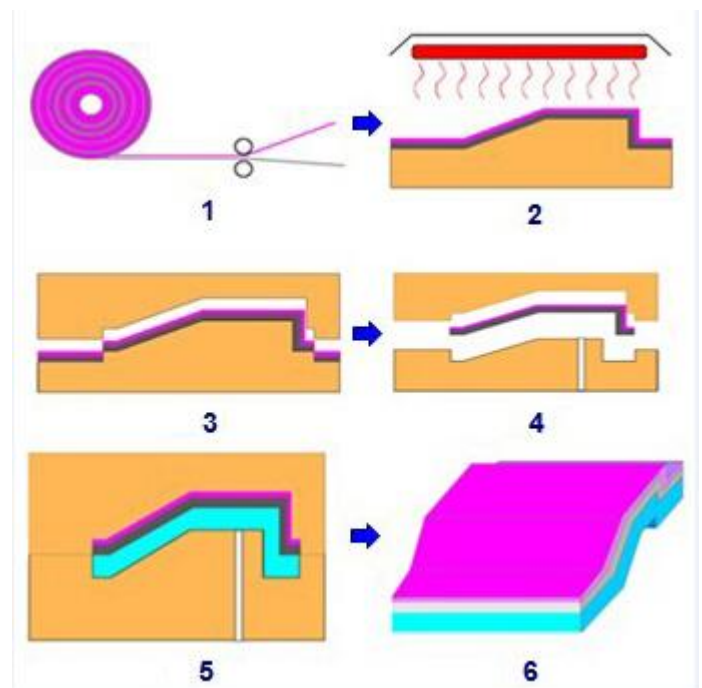
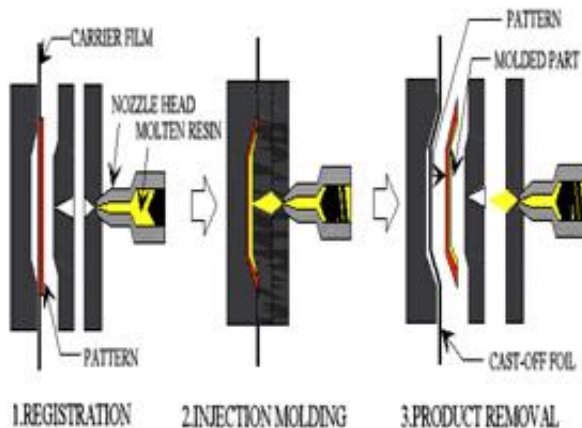


Figure 2. Schematic process flow of IML



### III. IMD /IML PRODUCT CHARACTERISTICS

Because the difference process between IMD and IML, their product characteristics are different also. The benefits and limitations of IMD and IML product is listed in Table 1 and Table 2.

TABLE I. BENEFITS AND LIMITATIONS OF THE IMD PRODUCT<sup>[10]</sup>

<i>Benefits</i>	<i>limitations</i>
Direct decoration process during injection molding (cost attractive!)	Additional investments for technical options (foil feeding device, IMD Mold, vac pump)
Multiple number of designs for interior and exterior applications are available	No partial decoration of part
Surface structures in the mold are transferred onto part with almost no losses	Low 3D capabilities
Dry process at customer => no environmental involvements	Training of operators and setup personnel is required
Quick design interchange by just switching the decor foils of the foil feeding device	Dust-free environment is required

TABLE II. BENEFITS AND LIMITATIONS OF THE IML PRODUCT<sup>[10]</sup>

<i>Benefits</i>	<i>limitations</i>
Higher decoration depths Compared with IMD	Additional investments for vac forming and cutting tools
Flow lines are hidden by insert	No single picture designs
Usually standard mold suitable for Insert Molding	Backing foil material requires compatible resin => limited material alternatives decoration ends in between certain limits before the parting line
Metallized foils available	Tolerance approx. 0,30 mm $\pm$ 0,2 mm
Dry process at customer => no environmental implications	-
Surface structures in the mold are	-

<i>Benefits</i>	<i>limitations</i>
transferred onto part with almost no losses when designed accordingly	
Lower design distortion compared with Cubic Printing	-
Feasible for partial decoration	-

### IV. IMD/IML APPLICATIONS

IMD/IML technology not only can achieve injection molding, decorative integration and complete the process at once, but also can make a variety of special effects such as convex bubble buttons, metal mirror, or eliminate smooth, metal wire drawing pattern, the back light transmittance, Braille, Braille patterns, etc. It is highly decorative and functional.

IMD/IML mainly has application in computer industry, such as keyboards, Buttons, mouse shells, surface shells, etc. And in the communications industry, such as the phone keypad, phone lenses, color shell of mobile phones, the PHS and fixed telephone panels, window lenses, etc.

Other industries are medical equipment, cosmetics boxes, decorative boxes, toys, sports and recreation supplies, etc.

The making process and applications of IMD/IML are shown from Fig.3 to Fig .5<sup>[11-13]</sup>.

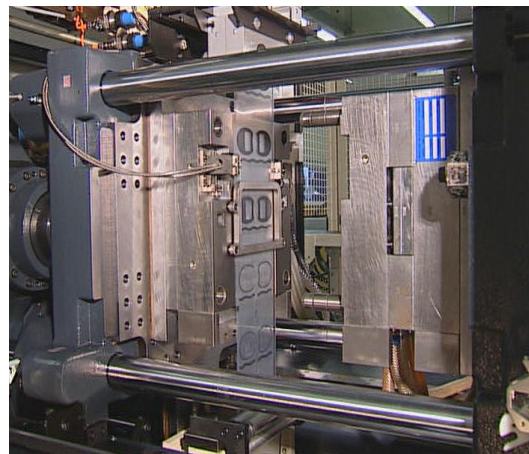


Figure 3 The way of the foil through IMD-Mold



Figure 4 Foils for endless and single picture

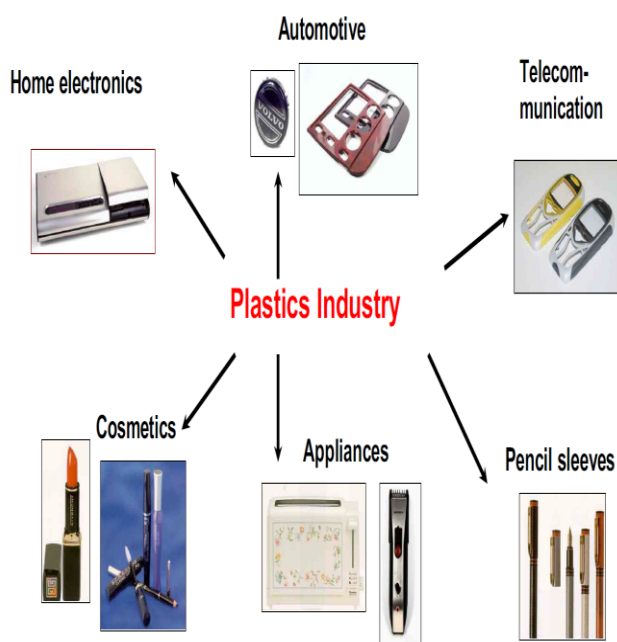


Figure 5 Applications of IMD/IML

## V. SUMMARY

At present, IMD/IML technology is the best new technology that substitutes for the plastic spray paint and electroplating processing. It also can reduce the follow-up injection processing. To promote and popularize it in the plastics industry not only can really achieve energy saving and environmental protection significance but also generates huge economic benefits and environmental benefits for society and enterprises.

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