SunHytek FIM / IMD Products

FILM INSERT MOULDING (FIM)

Film Insert Moulding (FIM) is an ever-increasing way of integrating printed graphics into 3D plastic parts. These parts are then used in numerous applications such as automotive panels, automotive trims, brown/white goods and consumer electronics. FIM is also used as part of the process to produce fully integrated and decorated printed electronic parts, known as In-Mould Electronics (IME). Again the use is gaining momentum and increasing rapidly, with the finished parts featuring fully integrated electronics, displays and printed graphics in a single discreet unit.

This article looks to give an overview of Film Insert Moulding (FIM) and introduces some products that have been specifically formulated for such use.

3D FORMING OF FILMS

In general, there are two commonly used but different processes for 3D forming of printed films, thermoforming and high-pressure forming (HPF). About 30 years ago the company Covestro (formerly Bayer) started developing the process of high-pressure forming, HPF.

HPF process

A polymer film is clamped into an exact position and heated to the glass transition temperature (Tg) for the specific polymer film. In the next step, the heated film is forced into the mould using heated and compressed air at high pressure (up to 300 bar). The glass transition temperature of the polymer film is lower than the actual melting temperature of the same film, it is the point where the polymer becomes soft and starts to flow. The advantage of this process is very precise forming with an accuracy of ±0.3mm. In addition, during processing of textured or matt films, the films do not melt, due to this lower forming temperature, and therefore they maintain their surface appearance, i.e. they do not become glossier and there will be no damage to the film structure. Furthermore, the deformation of any design motive is consistent and can be compensated for with an initial “distortion print”.

The HPF process is successfully used to produce complex 3D moulded designs such as 3D speedometers dials, instrument panels, mobile phone housing and fascia control panels.

Thermoforming

In this process the film is heated with radiators to a temperature significantly above the glass temperature (Tg) of the polymer film and is subsequently pulled into or over the heated tool/mould with a vacuum, compressed air or mechanically pressed into a certain shape with a stamping tool.
Compared to HPF this method means a higher degree of film stretching with a reduced accuracy of ±1mm. This process is preferred for large parts or where continuous decoration does not require forming with an exact position. Polycarbonate films are preferred for these applications, especially for automotive interiors. Polycarbonate shows excellent heat forming properties and with HPF you can process materials with a thickness of up to 12 mm. Some well-known brands are Makrofol and Lexan films.

FILM-INSERT-MOULDING (FIM)

Film-Insert Moulding (FIM) is the back injection moulding of 3D formed polymer films for production of decorated or functional plastic components.

There are several other commonly used terms for Film-Insert Moulding (FIM), such as In-Mould-Film (IMF), Insert Moulding (IM), In-Mould Decoration (IMD) and In-Mould-Labelling (IML). The latter is mainly used in the packaging industry, where back injection moulding of decorated films/labels is used to produce completed

packages (e.g. margarine containers). The term In-Mould Decoration (IMD) is often used as generic term for all back-injection processes.

The Film Insert Moulding (FIM) process described in this article refers to back-injection moulding of 3D printed foils, which are then back-injection moulded with a thermoplastic polymer material. The back-injection mould material is most commonly PC, PC/ABS, ABS, PMMA, etc dependant on the final application.

The steps of the Film Insert Moulding (FIM) process

1. Printing: The preferred and most common printing process is screen printing and because of the forming process the specific screen ink must be very flexible and resistant to the high melting temperatures and shear forces encountered during the back-injection process.

2. Forming: The foil is heated to approximately 145° C in the heating station with infra-red radiator (this approximately corresponds to the Tg of polycarbonate) and then formed in a mould for the specific part.

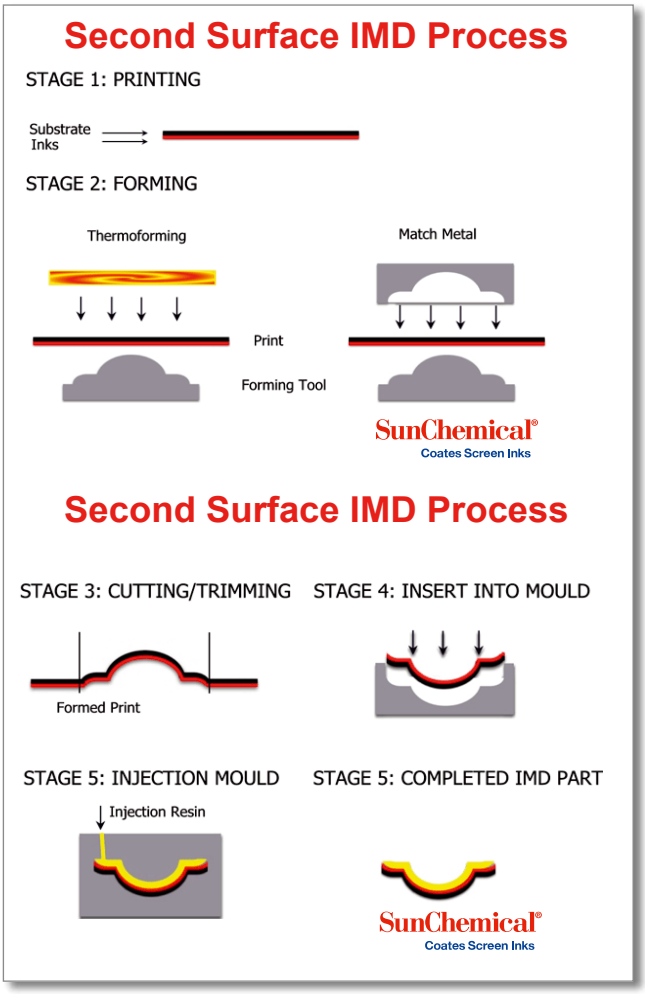
3. Die cutting: The foil is then cut to shape using a die cutting tool. Other cutting techniques can be used but are not so common.

4. Back-Injection: The 3D formed part is then loaded into a mould, the mould closed and resin injected onto the back of the 3D part. The layers of ink on the 3D part are resistant to the hot injection resin and allow a high bond strength between the 3D part and the injected resin, this is the key performance criteria of the inks for FIM. The back-injection resin is usually PC, PC/ABS or ABS, but other resins can be used.

For the FIM process, Sun Chemical offers the Decomold PC DMS series from the SunHytek™ product range. This is a 1-component solvent-based printing ink for this specific application, although the Decomold PC DMS series exhibit very good formability and therefore create very flexible, crack free ink films, fully suited for use on 3D formed parts, dials, facias, etc without any back injection.

THE MAIN PROPERTIES OF DECOMOLD PC DMS ARE:

- Suitable for FIM process
- Good forming properties
- Heat resistant
- Good adhesion on a variety of resins used for back-injection moulding
- Adhesion on PC, PC-blends, PET, and PVC foils
- Overprintability with a variety of our solvent based and UV-curing printing inks
- Suitable for overprinting with FasciaCoat WFC matt hardcoat



OUR COLOUR SERIES INCLUDE THE FOLLOWING BASIC SETTINGS

SunHytek Decomold PC DMS Inks			
Primrose	DMSY301	**Blue**	DMSB501
Golden Yellow	DMSY501	**Green**	DMSG501
HF Golden Yellow	DMSY507	**HF Green**	DMSG507
Orange	DMSO501	**Black**	DMSN501
HF Orange	DMSO507	**White**	DMSW501
HF Scarlet	DMSR207	**Clear**	DMSC501
Red	DMSR501	**Non-conducting Black**	DMSN301
Magenta	DMSM501	**Dense Black**	DMSN701
Violett	DMSV501	**Opaque White**	DMSW701
HF Violett	DMSV507		
SunHytek Decomold PC Reducers			
Thinner	TS55	**Anti-bubble Thinner**	TS13
Retarder	TS60		

This is a full range of strong, mono-pigmented colours. Together with white and black you will have a complete mixing system. Colours with HF are additional halogen free shades where the standard pigment cannot be deemed halogen free.

To complete the product range a 2-component ink series with a high resistence to wash out is under development.
For further information please contact our laboratory.

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