PENETRATING THE FIM/IME SUPPLY TRAIN

Electrification of the automotive industry has seen film insert moulding and in-mould electronics moving to vehicle exteriors, and screen printers could also benefit from the application of this technology in the medical equipment industry and beyond, predicts Douglas Gray

Douglas Gray is Senior Sales Manager APAC

Film insert moulding (FIM), and its high technology brother, in-mould electronics (IME), are little known in the world of industrial printing outside of companies involved in automotive interiors. Yet, this is an accessible segment that holds much potential for the screen printing community and product developers alike.

Equally, the process capabilities hold huge potential for all end user applications and might include: integrated symbols and graphics, light transmission features, capacitive touch, proximity sensing, and haptic beyond UV, scratch and abrasion resistance.

The output from FIM and IME are decorative and/or functional components whose manufacture most frequently starts with the screen printing process. Typically, a film substrate with a hard coat on the A face is used and the decorative and/or functional printing will be applied to the B face.

For the manufacturer, FIM process eliminates the need for post-moulding coating or painting of parts, resulting in savings in time, labour, material, VOC emissions and equipment investment. IME, whilst a slightly more complex process, has the same savings potential during manufacture. It brings additional benefits of replacing a complicated assembly derived from a complex, expensive bill of materials with the inherent supply chain and tooling costs with a single part.

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APPLICATIONS

The biggest adopter of these technologies is the automotive industry, where solutions are widely deployed in the cockpits of premium marques around the world. Climate control, lighting, steering wheel switches and infotainment system covers increasingly feature components derived from FIM and IME. The changing needs of the automotive industry inspired by electrification, increasing automotive intelligence and safety innovation mean that FIM and IME are moving to the vehicle exterior. This trend is more evidence of the aesthetic, cost and capability of both these processes to meet the needs of a demanding, fast evolving market.

Beyond automotive, the appliance and medical equipment industry hold potential and there are even examples where single-use biosensor products have enjoyed the benefits of this technology.

SCREEN PRINTING

FIM and IME feature several different process steps. The first stage is the screen printing of decorative and/or functional inks with enhanced properties to withstand subsequent high pressure forming and the temperature and abrasion brought about during injection moulding. Despite being a little exotic, the substrates and inks use standard screen equipment common throughout the industry and process in the same way.

FORMING

The next step for FIM is forming, when the printed foil is given the all-important 3D geometry. Depending on product design this can be done by a range of forming processes ranging from embossing, thermo, vacuum and high pressure forming. Where the part has a printed icon, positioning is critical and so the capability of the forming process in terms of accuracy and repeatability is absolutely key.

Additionally, these forming processes offer differing outputs and capabilities in respect to material stretch and distortion, wall thickness, part size, radii and draw height so care should be taken when nominating the process.

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Key considerations when making the decision on the forming process relate to the fundamental product design in respect to geometry, aesthetics and material performance. Regardless of the forming process, selected part-specific tooling will

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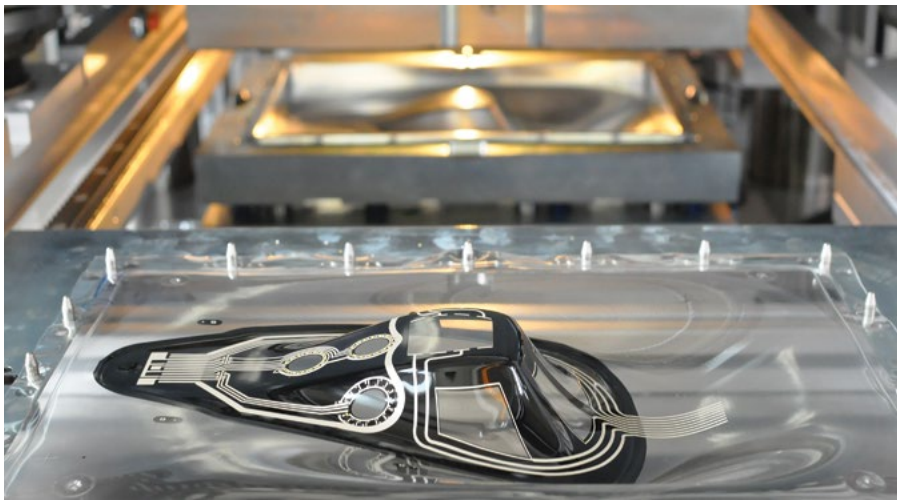

Forming of component with conductive ink and LEDs during IME process

Final assembly of Niebling forming machines at the company's factory in Penzberg, Germany

be required. The accuracy and quality of this tooling will have a significant impact on the quality of the forming and ultimately the final product.

UV ACTIVATION

At this stage we still have a sheet with multiple formed impressions. The sheet is then exposed to a high dose of UV energy in what may appear to be a conventional tunnel-format UV machine. The purpose of this UV dose is to activate the UV hardcoat and enable the designed surface properties. This unit differs somewhat from a standard UV dryer in that it must deliver 2W of UV energy without heating the sheet above 85°C. At higher than 85°C the forming geometry will change, making the parts geometrically incompatible with subsequent processing.

TRIMMING

The penultimate stage in FIM is to trim the formed impressions from the sheet into the discrete parts. This is generally done using a die trimming press. Again, specific tooling combined with accuracy and repeatability is critical in order to ensure the resultant parts are correct for the subsequent injection moulding process.

INJECTION MOULDING

Finally the forming is ready for injection moulding where our printed and formed part constitutes an insert placed into the tool. In FIM the formed part is back moulded and generally the A-side of the original foil will be the contact surface. In IME the entire functional insert is encapsulated, bringing additional aesthetic virtue and durability. This process can be one-component (1K) or two-component (2K) depending on product design but the output is always durable, often beautiful and increasingly functional.

This is a complex, tight tolerance series of process steps but screen printers should not be deterred. Knowledge of the entire value train is of course interesting but

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in practice the supply chain is generally multi-tiered, where printing, forming and moulding might be undertaken by different vendors. The challenge for printers is not to offer the entire FIM or IME process, rather it is to engage and penetrate the supply chain. ■

Radome device reflects the brand and is also transparent to radar and or lidar technologies

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SCAN ME