FILM-INSERT MOULDING – THE NEXT LEVEL

Tabo Sinyinda and Jake Clark of Natgraph, explain why film-insert moulding has become a widely used method of production where durability and intricacy are key

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Natgraph's FIM conveyor

Film-insert moulding (FIM) is a manufacturing process that combines the benefits of injection moulding and printing technology. The result produces high-quality, complex and durable parts with intricate designs. It is a widely used method in industries such as automotive, electronics and medical devices

The process of FIM involves the use of printed film that is inserted into an injection-moulding tool. The tool then moulds the plastic around the film to create a seamless, integrated part. The film used, can be made from various materials such as polyester, polycarbonate, vinyl and polypropylene.

FIM PROCESS

The FIM process consists of five key stages – printing, forming, UV curing, cutting and moulding. The first step, is the creation of the printed film or the pre-formed, decoratively patterned film. The film can be printed with high-resolution images, patterns or textures to achieve a desired aesthetic. The printing can be realised using a range of techniques, such as screen, offset or digital printing. The film can also be pre-formed using thermoforming, where it is heated until it becomes pliable and then moulded into the desired shape.

The film is subsequently placed into an injection-moulding tool. The tool consists of two halves – one fixed and the other moveable. The fixed half is attached to the injection-moulding machine, which injects molten plastic into the tool. The movable half then closes over the fixed half and the plastic is moulded around the film.

The process of moulding the plastic around the film is attained through a combination of heat and pressure. The tool is heated to a specific temperature, which varies depending on the type of plastic being used. The plastic is then injected at a high pressure, which ensures that it fills all the cavities and creates a seamless bond with the film. The pressure is maintained until the plastic cools and solidifies, after which the tool is opened and the part ejected.

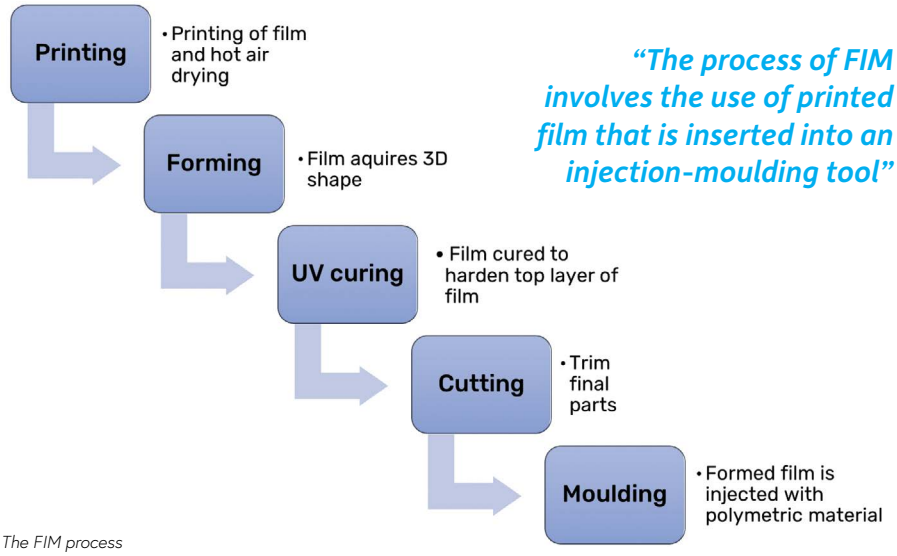
INTRICACY, INTEGRATION AND DURABILITY

One of the main advantages of FIM, is its ability to produce parts with intricate designs and patterns. The printed film can be customised to include high-resolution images or complex patterns, impossible to achieve through injection moulding alone. In addition, it is easy to integrate components, such as lens and body, into one unit using a single, hard-coated film.

The film can withstand the high temperatures and pressures of the injection-moulding process, ensuring that the final part is of high quality and durability.

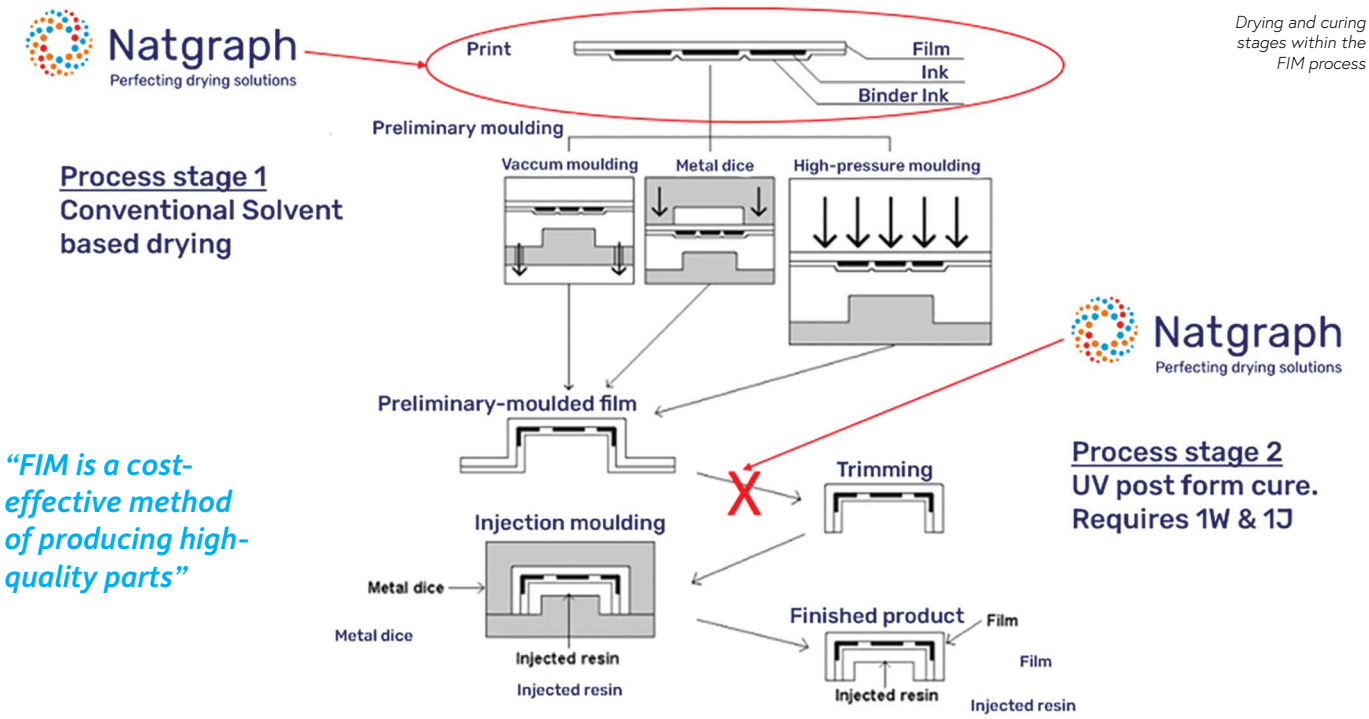
PRECISION AND CONSISTENCY

Another bonus of FIM, is its ability to produce parts with a high degree of precision and consistency. The use of a pre-formed or printed film ensures that the part is moulded to exact specifications, reducing the risk of errors or defects. The process also allows for the creation of complex geometries and shapes, which would be difficult to achieve using traditional injection-moulding methods.



The FIM process

"The process of FIM involves the use of printed film that is inserted into an injection-moulding tool"



Drying and curing stages within the FIM process

"FIM is a cost-effective method of producing high-quality parts"

COST-EFFECTIVE AND ECO-FRIENDLY

FIM is a cost-effective method of producing high-quality parts. The use of a pre-formed or printed film, eliminates the need for expensive moulds, which can be a significant cost for small production runs.

The process also reduces the quantity of material waste, as the film is used as a substrate for the plastic. This lowers the amount required to produce the part. FIM is an environmentally friendly method of manufacturing. The process reduces the amount of material waste and energy consumption, making it a more sustainable option than traditional injection-moulding methods.

RESEARCH AND DEVELOPMENT

The FIM process has a very narrow processing window. During the UV-curing process, utilised to harden the top of the polymeric layer, it is critical that sufficient power and energy are delivered to the component, without it being deformed by high temperatures. This is a key process that requires high precision and control.

Existing machinery has been available to UV cure the coating below the required temperature. However, it is extremely expensive, laboratory based and unavailable on a commercial scale. The team at Natgraph, sought to create a cheaper process, with greater technical abilities, in order to provide an appreciable improvement to an existing process.

Natgraph has developed a high-performance production machine which utilises high-power UV at low operating temperatures. The machine was primarily developed for the curing of hard coating applied to moulded polymetric sheets in the automotive sector. However, it also has potential for other applications. ■

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Side view of the FIM machine

Top view of the FIM machine