Description

Image

Image caption

(1) Decorated bicycle helmet © Hans at Pixabay [Public domain] (2) Credit Card in-molded decorated © at Pixabay [Public domain]

The process

IN-MOLD DECORATION (IMD) allows accurately registered colors, designs and print to be applied to injection molded components without any secondary processing. The image, which can be full-color, is printed onto a polyester or polycarbonate film is called the 'foil'. If the product is flat or mildly curved, the foil is fed as a continuous strip, or cut and placed directly, in the mold. If true 3D components are to be made, the foil is first thermally molded to the shape of the component, then placed in the mold cavity. Hot liquid resin is injected behind the foil, bonding its surface to the molding resin and forming a integrally decorated component.

Process schematic

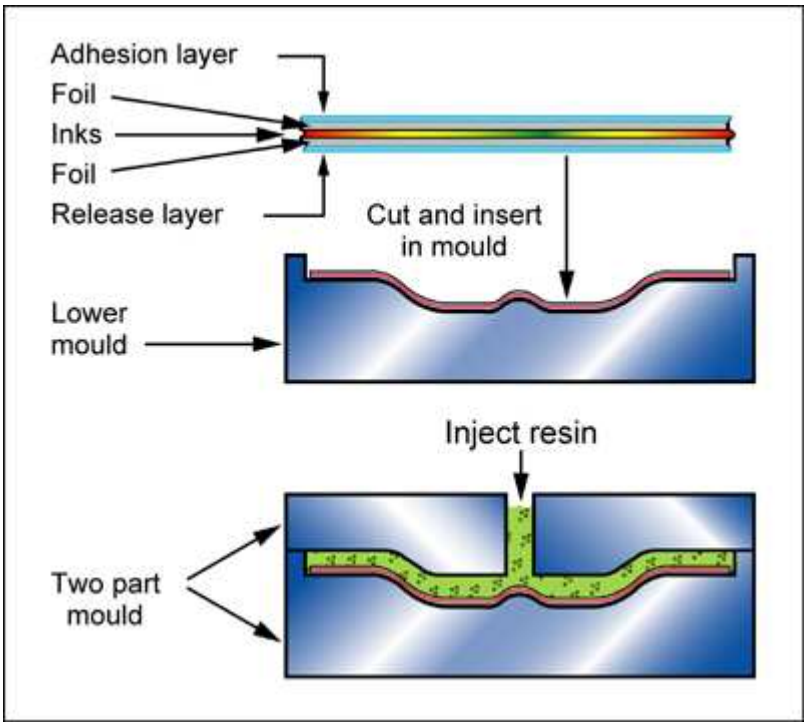

Figure caption

In-mold

Material compatibility

Polymers - thermoplastics	✓
Polymers - thermosets	✓

Function of treatment

Corrosion protection (aqueous)	✓
Color	✓
Reflectivity	✓
Surface texture	✓

Economic compatibility

Relative tooling cost	low
Relative equipment cost	high
Labor intensity	low

Physical and quality attributes

Surface roughness (A=v. smooth)	A			
Curved surface coverage	Average			
Coating thickness	0.394	-	19.7	mil
Surface hardness	5	-	15	Vickers
Processing temperature	260	-	395	°F

Process characteristics

Discrete	✓

Supporting information

Design guidelines

The figure shows the build-up of a more complex foil. The decorative coatings are applied to the foil in reverse order: the release coating directly onto the foil, then the various color coatings, and finally the adhesive layer. By printing the graphics on the second surface, the graphics are held within two thin polymer layers, protecting it from wear and tear. Change of decoration simply requires a change of foil, without changing the mold or the material. Very thin components can be decorated in this way - credit cards with a 0.8mm wall thickness, for example, are decorated by the IMD process.

Technical notes

In the continuous IMD process modified hot-stamping foils are passed from a roller into the injection mold. On injection, the pressure and temperature of the melted polymer releases the carrier film, bonds it to the molding and presses it into the die-cavity, thereby molding the two-dimensional film into three dimensional geometry; however, the pattern can sometimes become distorted. In the discrete process, the foil is cut and placed in the mold. Complex shapes require that the foil is first thermally molded to the approximate shape of the mold cavity before insertion. Most thermoplastics - including polycarbonate, but not, however, polyethylene - can be decorated by IMD without problems.

Typical uses

Mobile phone front and back covers, keypads, lenses, computer terminals, automotive heater controls, dashboards, toggle switches, credit cards.

The economics

IMD is simple and fast, and it reduces the number of steps in the manufacturing process, allowing the low-cost decoration of moldings that previously required a separate, costly, hot-stamping process, and it offers a greater range of graphics and colors.

The environment

IMD complies with the stringent environmental standards of the automotive industry. Recycled polymers can be used, as long as they have no gross contamination. The mold resin and the film can both be of the same material type, aiding recyclability.

Links

MaterialUniverse

Reference