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Multishot Injection Molding: Definitions and Rotation Mechanisms

Key Points:

*Multishot molding
fuels innovation in
material and
product design*

Insert Molding

*Multishot / Two
Shot Molding*

*Applications for
Multishot*

*Rotation
Mechanisms*

- *Rotary Platen*
- *Rotary Die*
- *Rotary Index
Platen*

*Designing for
Multishot*

It is said that necessity is the mother of invention and that is true for the birth of overmolding. The need for permanent lettering on typewriter keys spawned this new technology. The process used to create overmolded parts in this way had two steps: one step to mold the form of the key, and another in a different machine to mold the graphics onto the key.

Innovations have made this process more efficient, combining the two steps into a molding process that can be achieved with one mold in one machine with multiple injection units, known as multishot molding. Toothbrushes and disposable razors were some of the first products made using this process. Manufacturers could combine a hard plastic base, or substrate, with an elastomer as the second shot, offering a grip surface and a different color. These consumer products were also being produced by the millions, justifying the higher cost of multishot tooling compared to traditional single shot tooling.

As the multishot process was perfected and additional innovations made tooling and machines less costly, the multishot process became more affordable and attractive for producing items that would not be manufactured in such high volumes.

Limitations in the variety of materials that could be bonded together with multishot challenged resin suppliers to formulate new compounds that could be used. The availability of new materials then spurred the creation of new applications. With the recent development of vulcanized thermoplastic elastomers (TPE), the door has been opened for multishot design for applications where conditions require extreme heat and/or chemical resistance.

Not every injection molder has made the investment in the equipment and training needed to offer multishot technology so it remains a specialty niche for molders who also help customers recognize potential ways to improve products by applying multishot principles.



An assembly operation is eliminated and the gasket is always in the correct position when it is bonded to the fitting with multishot technology

Insert Molding

Insert molding involves two different injection molding processes, each with their own unique mold. Insert molding can also be used to mold plastic around a non-plastic part, but for our purposes here we will be talking about the bonding of two plastic materials into one part.

Conventional injection molding equipment is used to produce one part. This is then transferred and held in a second mold for the injection of a second material.

The transfer between the two shots can be achieved by hand or by robot.

Hand loaded: a machine operator loads the molded base part into the second mold.

- Advantages: this might be appropriate for situations where volumes are low and tooling investment must be kept to a minimum.
- Disadvantages: Part price is higher; bonding of the two materials is not maximized because the first shot is already fully cured; consistency may be compromised and scrap rates high.

Robotically loaded: a robot transfers the base part from the first machine immediately to the second mold for overmolding.

- Advantages: Conventional injection molding equipment can be used; better consistency than hand loaded; positioning of the two materials may be better than hand loaded.
- Disadvantages: requires capital investment in robotics and end-of-arm tooling; bonding of two materials is not maximized.

Multishot Molding can be used to bond two or more compatible materials together into one cohesive unit.

Two Shot Molding

Also called **multishot molding**, this process allows for two different materials to be molded in a single molding cycle.

A two shot injection molding machine has two independent barrels that each have their own set of processing specifications.

During each molding cycle, the base part is created in one part of the mold, while the overmold is applied at the same time in another part of the mold.

The mold becomes positioned between cycles by a rotary mechanism: **Rotary Platen, Rotary Die or Rotary Index Plate**. The type of mechanism used for rotation has great implications for the design features of the finished part.

Applications for Multishot Technology

- Eliminate secondary operations

Multishot molding most often eliminates an assembly when compared to alternate designs. Products can be improved and some products are only possible with the superior chemical bonding that is attained with multishot molding.

Costs can be reduced by eliminating the need to stock numerous parts and adhesives. Eliminating a manual assembly decreases costs while increasing the consistency and quality of the finished part.

- Shielding
- Gaskets & Seals
- Permanent graphics
- Soft grip surfaces
- Shock absorption
- Slip resistance
- Abrasion resistance
- Backlighting
- Impact protection
- Vibration dampening

Rotary Platen

Rotary Platen Two Shot Molding refers to a process where the rotation of the base part into the overmold cavity is accomplished by a rotary mechanism mounted onto the moving platen of the molding machine.

The term platen refers to the large steel surfaces where the mold is mounted into the press. The ejection system that removes the finished parts and runners from the mold is mounted to this platen.

Advantages:

- Since the base part is restrained in rotation, the overmold is always positioned correctly.
- Bonding of the two materials is maximized since the base part does not completely cool between cycles.
- Warpage is minimized because shrinking and cooling of the two materials occurs at the same time once the

finished part is ejected from the mold.

- Consistency is maximized and costs potentially reduced because of the elimination of human error.

Disadvantages:

- Mold cost is higher than simple insert molding.
- Some design limitations because of how the part is held in the mold.



Multishot design for this electronic housing creates an airtight button membrane to protect components and also provides a grip surface

Rotary Die

This is the process that was used to produce typewriter key caps with permanent graphics. The use of rotary dies is limited to small parts.

Molding of the two materials is done simultaneously. Rack and pinion or rotary driven mechanisms rotate the entire mold.

The type of mechanism used varies because all are custom built according to each part design.

Advantages:

- Excellent bonding and minimal warping, as above.
- The overmold can extend to both the cavity and core

of the mold, increasing design possibilities.

Disadvantages:

- Mold cost can be prohibitive because of custom built rotary mechanisms.
- Usually limited to small parts.

The type of mechanism used for rotation has great implications for the design features of the finished part.

Rotary Index Platen

This process is used when the second shot material is required on both the front and back sides of the first shot.

There is a center “floating” plate that holds the first shot part and rotates the part to a new set of cores and cavities.

Advantages:

- Extends design possibilities beyond the limitations of

the Rotary Platen concept by allowing the placement of the second shot of material on the front and back of the part.

- All of the advantages of Rotary Platen molding apply to Rotary Index Platen molding including exact positioning of the overmold, superior bonding of the two materials, minimal warpage from cooling, and

maximized consistency of parts.

Disadvantages:

- Mold cost is higher than rotary platen molding.
- Because of machinery and processing expertise needed, only a limited number of injection molders have the capability to offer this type of process.



Important user instructions are permanent when created with multishot technology

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Multishot Technology
for exceptional performance



Designing for multishot

In order to achieve an overmolded product with outstanding functional characteristics and good cosmetics at a reasonable price, the design phase needs to be integrated with the manufacturing phase.

Material Selection:

Choice of materials is critical for successful bonding. Not all overmold resins bond to all substrates. Carefully examine the material choice for the substrate. It may be necessary to rely on the design of the part to provide the necessary performance characteristics in instances when a high engineering grade of material does not have a suitable choice for an overmold resin.

Once you have selected a substrate, consider the necessary adhesion of the overmold resin. Look at the durometer

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or hardness that is desired and consider how the durometer affects abrasion resistance and tear strength that is needed in the finished part.

The environment in which the finished part will be used is always a factor when choosing a resin. Parts that will be exposed to the outdoors, extreme heat, or corrosive chemicals will require different resin combinations.

Design Tips:

Accent grooves between the substrate and overmold greatly enhance the appearance and overall manufacturability of the finished part. These grooves help reduce the visibility of the variation in the manufacturing process as well as give the mold builder an area that serves as shutoffs between the substrate and the

steel of the overmold cavity.

Overmold materials, especially TPEs, leave large gate vestiges. Consider gating methods that can be trimmed off and hidden.

The use of nominal wall sections and proper rib proportions will help solve many manufacturing related problems such as sink, warpage, and scuffing.

Design Collaboration:

Partner together with experts in multishot molding for guidance in part design and material selection. If you aren't ready for that yet, call on these experts to help you learn more about multishot so that you can venture into this area of manufacturing that has the potential to push you past your current limitations.



An elastomer molded to a rigid substrate provides a soft grip surface and color-coding