Plastics Finishing

Training Objectives

After watching the video and reviewing this printed material, the viewer will gain knowledge and understanding of the various plastic finishing processes used in industry and their application for finishing parts.

• the runnerless types of molds are explained
• post molding operations are described
• the basic methods of “applied” decoration methods are examined

The Plastic Molding Process

Injection molding is the principle manufacturing method for plastic part production. The two types of plastic used are thermoplastics and thermosets. Thermoplastics can be remelted and reused to make new parts, while thermosets cannot. The most common type used in plastics manufacturing are the thermoplastics.

Once produced, plastic parts may be subjected to one or more finishing processes, including:

• degating
• deflashing
• cleaning
• decorating

Degating

Injection molding is accomplished by the pressurized flow of molten plastic through a channel system of runners and gates into the mold cavity where the part is formed. The gate and runner typically remains attached to the part upon ejection from the mold. Degating is the process of removing the molded part from the gate and runner system. Degating can be accomplished by simply “snapping off” the runner and gate system, using hand tools such as side cutters, employing dedicated trimming fixtures, or by using special injection molding tooling such as the “cold-runner” three plate mold and runnerless style injection molds.

The cold-runner three plate mold consists of three separate plates which form the complete mold. These plates include the stripper plate, which contains the sprue, the middle or cavity plate, which holds the cavity, runner and gate, and the movable plate, which holds the molded part. This type of cold runner mold design automatically separates the runner system from the part each time the mold opens.

The basic function of runnerless style molds is to keep the molten plastic material in a liquid state during the cycling of the mold, thus preventing the solidification of the plastic material. Runnerless style molds are of three types: the hot sprue-gated mold, the hot-runner mold, and the insulated runner mold.
Deflashing

During the injection process, excess material, called “flash”, may leak out between mold cavity halves. Deflashing methods are used to remove this flash, and include: cutting and trimming, media blasting, or cryogenic deflashing.

Cutting and trimming are the most common methods of deflashing molded parts, and are performed manually using knives, or other cutting utensils.

Media blasting involves the spraying, or broadcasting, of either particulate polymers, or organic materials such as ground walnut shells, to break up both external and internal flash.

Cryogenic deflashing involves loading parts to a cryogenic deflashing machine where they are then tumbled or vibrated. Liquid nitrogen, carbon dioxide or dry ice is then added, quickly freezing and embrittling the thin flash on plastic parts. While still frozen, the parts are then blasted with media to break up and remove the flash.

Cleaning

Plastic parts often require some form of cleaning after molding. Processing aids, such as mold release agents may leave a residue, while grease and dirt can be picked up from the molding machine. Even the natural oils of the operator’s hands can interfere with final surface treatment. All these contaminants will interfere with the bonding action of any post-molding decoration or surface treatment. Cleaning is accomplished by spraying or dipping parts in a mild detergent solution followed by a final rinsing and drying.

Decorating

Virtually all molded plastic products receive some sort of final decoration. These decorations are either "molded-in" or "applied" types.

Molded-in decorations are those designed into the mold, such as textures; or by implant, as with two-shot molding. Color is considered a molded-in decoration by virtue of pre-colored resins injected into the mold.

Applied decorations are those added to the plastic part after molding. These applied decoration methods include:

- painting
- plating
- vacuum metallizing
- pad printing
- hot stamping
- silk screening
- fill and wipe

Liquid paints may be applied to plastic parts for many reasons, but usually to ensure proper color matching between adjacent plastic and non-plastic parts. The types of paint used on plastic molded parts include epoxy, polyurethane, enamel, acrylic, and latex. These paints are most commonly applied by conventional spray
Paints may also be applied using flow coating, which is a method employing several streams of paint directed at the plastic parts. Excess paint is collected as it drains off, where it is filtered and recirculated for reuse. After paint application, plastic parts are allowed to dry or cure. This may be done at room temperature or through the use of a curing oven.

Plating requires the plastic parts to be electrically conductive. To achieve this conductivity, the plastic parts are subjected to an electroless plating operation. Plastic parts are first submersed in a sulfuric chromic acid bath which slightly etches the plastic surface, creating microscopic pockmarks. The plastic parts are then placed in an activator bath, and an accelerator bath making the parts chemically attractive to the metals suspended in the electroless plating bath solution. These plating metals deposit and become trapped in the pockmarks. Electroless plating provides a dull metallic finish, and makes the parts electrically conductive. Electroless plating is also the first phase in the electrolytic plating process.

Electrolytic plating creates bright chrome surfaces. The conductive parts are negatively charged and referred to as the cathode, while the metals suspended in the bath are positively charged, and referred to as the anode. Actual plating occurs when these metals precipitate out of solution and adhere to the part surface.

Vacuum metallizing is a physical, rather than electrochemical, process of depositing a metal layer onto a plastic part’s surface. Plastic parts are first prepared with a lacquer and fixtured onto a rack. Small clips of the desired metal finish material are then strategically located on the rack, which is then placed into a vacuum chamber. Once the proper vacuum level is achieved, an electrical charge is applied to the metal clips. This causes them to vaporize, covering everything within the chamber, including the plastic parts, with a metal layer. Any metal or metal alloy can be vacuum metallized. But aluminum is the most popular because of its physical properties, and low cost.

Pad printing uses silicon rubber transfer pads to pick up ink or paint from a plate called a "cliché" on which there is an etched image. The cliché may be made of steel for larger productions run or made of nylon for shorter runs. Pad printing is widely used because of its ability to transfer images onto a wide range of surface types and geometries, and its wet-on-wet printing capabilities.

The hot stamping process uses heated silicon rubber dies to force ink from a foil film carrier onto the plastic part. The most typical hot stamping method is performed with parts held in a fixture and with the heated rubber die dropping vertically to force the foil against the part surface. After contact, the die retracts. The hot stamped part is then removed and replaced while the strip of foil indexes to an unused section.

In silk screening, an image is exposed onto a fabric screen containing a photosensitive chemical. The exposure "cures" the area not covered by the image and adheres the photosensitive chemical to the screen. The screen is then washed, rinsing away the uncured chemical, leaving only the actual image. The silk screen is then placed on the part. Ink or thick paint is then forced through the porous screen image and onto the part’s surface.

The fill and wipe process involves applying paint or ink to a part with a grooved or etched impression. The excess material is then wiped off, leaving material only in the impression area.
Review Questions

1. The type of plastic materials that can be re-melted and reused are called:
   a. thermosets
   b. resins
   c. polymers
   d. thermoplastics

2. "Flash" occurs at the:
   a. gates
   b. sprue interface
   c. mold cavity seams
   d. runner system

3. Decorations that are "molded-in" result from:
   a. higher injection pressure
   b. higher material temperature
   c. mold design
   d. post injection treatment

4. The term HVLP refers to a:
   a. plastic type
   b. injection machine type
   c. plating method
   d. painting method

5. The process by which suspended metals in a plating solution transfer to the part surface is called:
   a. adherence
   b. precipitation
   c. gleaning
   d. charging

6. The most common metal used in vacuum metallizing is:
   a. aluminum
   b. magnesium
   c. copper
   d. zinc

7. A specific advantage in pad printing is:
   a. high speed application
   b. low tooling cost
   c. excellent permeability
   d. wet-on-wet color capabilities

8. Silk screening is a:
   a. air curing masking process
   b. photosensitive chemical process
   c. metal transfer process
   d. spray painting process
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Answer Key

1. d
2. c
3. c
4. d
5. b
6. a
7. d
8. b