

# Hot Stamping

by M.A. Olsen President Kensol-Olsenmark, Inc

Hot stamping is a one-step dry method of marking that applies heat and pressure to a roll film. The surface to be marked requires no pretreatment.

Roll leaf and heat transfers are films that have been pre coated with a metallic or pigmented finish (roll leaf) or a film that has been preprinted with a multi-color design (heat transfers).

Of all decorating methods, the application of roll leaf and heat transfers gives the designer the most freedom to obtain brilliant metallic finishes, wood grain and pearlescent coatings, opaque matte or gloss colors, transparent or fluorescent colors, and multi-color designs.

The most dramatic development is the use of roll leaf on exterior parts. The automotive industry is using argent silvers and chromium leaf on tail lenses, rear deck panels, front grilles, and lens openings.

## Application methods

A roll leaf or heat transfer coating is applied to a plastic surface by pressing a heated metal or rubber die against the film which is in contact with the plastic. After a dwell period, normally of less than 1 sec., the coating is released from the carrier film and adheres to the plastic surface. When the die is removed, the part is completely dry and can be handled immediately.

There are three basic effects

that can be obtained through the use of roll leaf and heat transfers:

1) An inlaid or de bossed effect (roll leaf only) in which a heated metal die is used to deposit a roll leaf coating below the surface of the plastic to be decorated. A cosmetic compact is one example.

2) A surface coating of roll leaf or heat transfer is transferred by a heated silicone rubber die or roller onto a smooth or slightly textured surface. The sides of a wood grained TV or radio cabinet are decorated with this technique.

3) An embossed effect is obtained when a roll leaf or transfer coating is deposited onto the surface of a raised section in the plastic. This normally is applied using a silicone rubber die. The lettering and chrome border highlighting on automobile instrument panels is an example of this effect.

## Roll leaf and heat transfers

Any roll leaf or heat transfer consists of several layers of coatings which are released from a carrier film and deposited onto a substrate. A relatively simple color or metallic foil consists of a carrier which in most instances is a thin film (0.5 to 1 mil) of cellulose acetate or polyester. In the manufacture of roll leaf, this carrier is coated on one side with a release agent (most commonly a wax) which melts when heat is applied to the uncoated side of the carrier. The carrier then passes through a color or metallic coating process.

The next coat is a heat-activated sizing. To obtain acceptable adhesion, the sizing must be formulated to bond onto the particular material to be decorated.

Bright imitation gold accounts for approximately 50% of all roll leaf sales. In the manufacture of metallized imitation gold, the dye coat is transparent yellow. A thin aluminum coating is plated onto the film in a vacuum metallizing operation. The yellow dye changes the chrome appearance of the metallized aluminum to a lustrous gold finish. Red, blue, green, and other dyes can be used to obtain unlimited metallic effects. All metallized foils must have a polyester carrier strip.

When extreme abrasion and solvent-resistance is required, a protective top-coat is added. This coating is applied between the release coat and the color coat in pigment foils. In dyed metallic, the dye is added normally to the protective topcoat. Protective topcoats have been developed to protect the roll leaf from alcohol (common in the cosmetic industry), salt spray (for automotive applications), detergents (for appliances and housewares), etc.

A more complex roll leaf construction is used in the manufacture of wood grain foils. In some wood grains, more than five coatings are applied. The first is the release, second is a protective topcoat, and the third coat is a grain. This grain is applied by a

# Hot Stamping

by M.A. Olsen President Kensol-Olsenmark, Inc

textured roller engraved to simulate a particular wood grain. The fourth is a base coating which is a solid pigment color to complete the two-tone effect. The size coating is then applied to complete the process. Wood grain roll leaf is available with a glossy (lacquered) finish or with a matte (hand-rubbed) finish.

In general, most roll leaves are formulated to release at from 250 to 375 F. Manufacturers have been developing foils that will release at lower temperatures for several technical reasons. Lower die heats will reduce the distortion when hot-stamping thin-wall parts, and also will lengthen the life of silicone rubber dies and the soft metal dies (brass, zinc, etc.).

Heat transfers have certain advantages when two or more colors must be applied in register to an item. Since the carrier is printed by the supplier, exact color registration is guaranteed. Standard end less patterns in multicolored and metallized finishes are available. When applying multicolored by the roll leaf process, the item normally must be passed through the press several times. The number of passes equals the number of colors to be applied.

Most transfers are formulated with a sizing so that they adhere to the plastic surface, however, the latest development is the formulation of inks with the same plastic as the object to be decorated. This results in fusion of the design

when heat is applied. The superior abrasion resistance of this type of transfer eliminates the need for a protective topcoat.

## Equipment and tooling

There are basically two types of machines -reciprocating and rotary. The reciprocating, or upright press is recommended when applying a design onto a flat, convex, or concave surface. It is also used to mark cylindrical shapes where the marking area does not exceed one-fourth of the circumference. The heated platen of a reciprocating press has been made larger than 24 by 36 in. Machines of this size have been used to apply a decorative bright chrome or simulated gold border on car grilles and on the bezel of TV sets. Since a silicone rubber die is used to coat a raised rib which is normally less than 1/8 in. wide, the pressure required is quite low, usually under 10 tons. To save roll leaf, four narrow rolls are used; they are positioned in the form of a rectangle to cover the border.

Rotary-type machines are recommended when decorating more than 90 degrees of a cylindrically shaped object or, when more than 50 square inch in a solid concentrated area are to be coated.

Besides accurate heat, pressure, and dwell time controls, a reciprocating press should have independent down and up stroke speed valves. The roll leaf attachment rollers should have adjustable rotational speed valves and

some method of delaying the pull of the roll leaf after the head has released from the work.

Hot stamping and heat transfer decorating is easily automated. Large injection molded parts normally can be decorated at the molding machine by the machine operator. In this instance, hand feeding and hand removal will more than keep up with the cycle of the molding machine.

On smaller parts, feeders, such as turn-tables, hoppers, conveyors, etc., can be devised to give practically any production rate.

The tooling required to perform a hot stamping operation consists of a heated die or roller and fixture which supports and positions the plastic part. It is extremely important that the die and fixture be properly designed in order to produce a quality part and cut down rejects. No matter how good the tooling may be, it cannot overcome part variations caused by poor design or molding techniques.

A hot stamping die can be of metal or silicone rubber. It is important that the die be a good conductor of heat. For a decorative design or functional marking to be applied to a smooth or slightly textured surface, an engraved metal or molded rubber die must be used. A quality metal die is almost always hand engraved (by pantograph) onto a steel or brass blank. The blank first must be shaped to the contour of the part if the surface is other

# Hot Stamping

by M.A. Olsen President Kensol-Olsenmark, Inc

than flat. Black-and-white artwork to scale must be supplied. Because of the skilled labor required, engraved metal dies are quite expensive. Many times, photoengraved zinc, magnesium, or copper dies can be used if the length of run prohibits the investment in an engraved die. These inexpensive dies, which are made by an acid-etching process, also are used in prototype work.

Molded silicone rubber dies have been used successfully to apply decorative logos, identifying marks, etc., on to plastic surfaces which have surface imperfections, variations, or on to surfaces which could not take the stress applied by a metal die. The surface of a molded rubber die will flex at low pressures and conform to irregularities in the part. However, if too much pressure is applied, the stretch in the rubber will cause distortions of the mark.

Surface coating is always done through the use of silicone rubber. A reciprocating press utilizes silicone rubber in sheet form with an aluminum or steel backing. Most rotary machines use a seamless rubber coating on a steel or aluminum roller. The part should be so designed that the area to be coated is on one plane or in the form of a cylinder. No protrusions can be in the near vicinity of the area to be coated.

Silicone rubber is available on steel or aluminum. Aluminum backing has several advantages

over steel. It is easier to cut, can be readily formed, and it conducts heat better.

After the proper thicknesses of rubber and metal have been determined, the rubber is cut to the proper size. If insufficient lap is allowed, poor results will be obtained due to lateral shift in the rubber. Chipping of the rubber also can occur. With proper cutting techniques and good part design, up to 50,000 impressions can be expected from a silicone rubber pad.

In many cases, the area to be decorated by a reciprocating press is not flat. The part design may call for the coating of a convex, concave, or irregular surface. In these cases, a blank must be machined to match the contour. The shape of the blank cannot match the part exactly, since rubber and aluminum sheet must be fastened to this blank. Rubber with 0.06 or 0.03 inch aluminum backing is used for ease of forming it to the shape of the part. In certain instances, it is necessary to have the silicone manufacturer coat the shaped blank rather than attempt to form dies from sheet stock.

For roll-on applications, seamless rollers can be obtained that have the same characteristics as sheet rubber. Rollers, 4 inch or larger in diameter, both internally and externally heated, and with at least an 0.125 inch rubber coating, are most suitable for roll-on applications.

Fixtures used in leaf stamping

and transfer decoration serve two purposes. They position the item to be decorated in the proper place so that the die will contact the plastic exactly where wanted, and they support the under surface of the item so that it will not flex and crack or craze. Aluminum is the most popular material for fixtures since it is durable, can be easily machined, and is light in weight. Weight of the fixture can be an important factor when the tooling must be attached to turntable and sliding table feeders.

When machining a metal nest for multi-cavity parts, an average cavity is assumed. Before the fixture is used, it should be checked to see that all pressure-bearing areas are supported. This is done applying machinist's bluing to the under-side of the part and fitting it to the fixture. Support areas are modified until the best possible transfer of bluing onto these areas is obtained.

In practically any hot stamping operation with a reciprocating press, a make-ready must be applied to the fixture or bed. This can consist of thin pressboard, cardboard, sticky-back cork material, or thin rubber. It is almost impossible to get a good uniform stamping job without some cushion on the support area.











