

preheat the charge before its placement into the mold; this softens the polymer and shortens the production cycle time. Preheating methods include infrared heaters, convection heating in an oven, and use of a heated rotating screw in a barrel. The latter technique (borrowed from injection molding) is also used to meter the amount of the charge. Compression molding presses are oriented vertically and contain two platens to which the mold halves are fastened تثبيتها. The presses involve either of two types of actuation:

- 1) up stroke of the bottom platen or
- 2) down stroke of the top platen.

They are generally powered by a hydraulic cylinder that can be designed to provide clamping capacities up to several hundred tons. There is no sprue and runner system in a compression mold, and the process itself is generally limited to simpler part geometries because of the lower flow capabilities of the starting thermosetting materials. However, facility تسهيل must be made for heating the mold, usually accomplished إنجاز by electric resistance heating, steam, or hot oil circulation. Compression molds can be classified as

Hand molds قوالب اليد, used for trial runs;

Semiautomatic نصف إليه, in which the press follows a programmed cycle but the operator manually loads and unloads the press; and

Automatic تلقائي, which operate under a fully automatic press cycle (including automatic loading and unloading).

Materials for compression molding include phenolics الفينول, melamine, urea-formaldehyde, epoxies, urethanes, and elastomers. Typical moldings include electric plugs and sockets, pot handles, and dinnerware plates.

Advantages of compression molding in these applications include:

- (1) molds that are simpler and less expensive أبسط وأقل تكلفة,
- (2) less scrap أقل الخردة, and
- (3) low residual stresses الاجهادات المتبقية منخفضة in the molded parts.

A typical disadvantage is longer cycle times and therefore lower production rates.

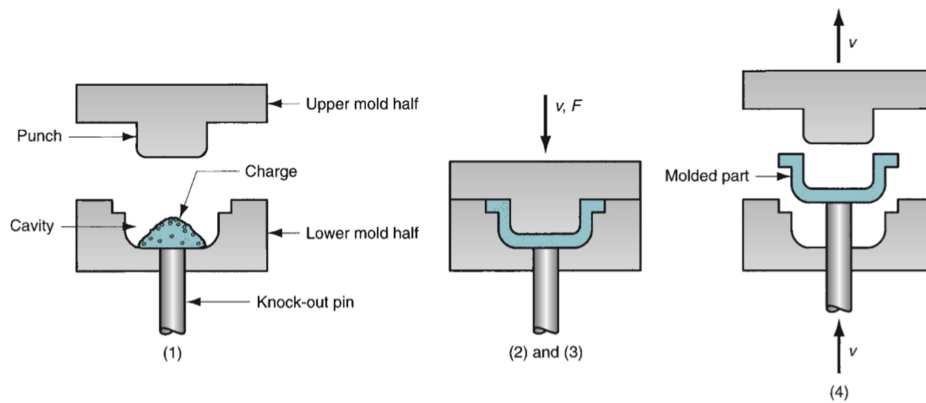


FIGURE 3. Compression molding for thermosetting plastics: (1) charge is loaded; (2) and (3) charge is compressed and dried *وضغطت وجففت*; and (4) part is ejected and removed.

2 TRANSFER MOLDING

In this process, a thermosetting charge is loaded into a chamber immediately a head of the mold cavity, where it is heated; pressure is then applied to force the softened polymer to flow into the heated mold where drying occurs *يحدث تجفيف*. There are two variants of the process, illustrated in Figure 4:

(a) **Pot transfer molding** *الصب بنقل الوعاء*, in which the charge is injected from a “pot” through a vertical sprue channel into the cavity; and

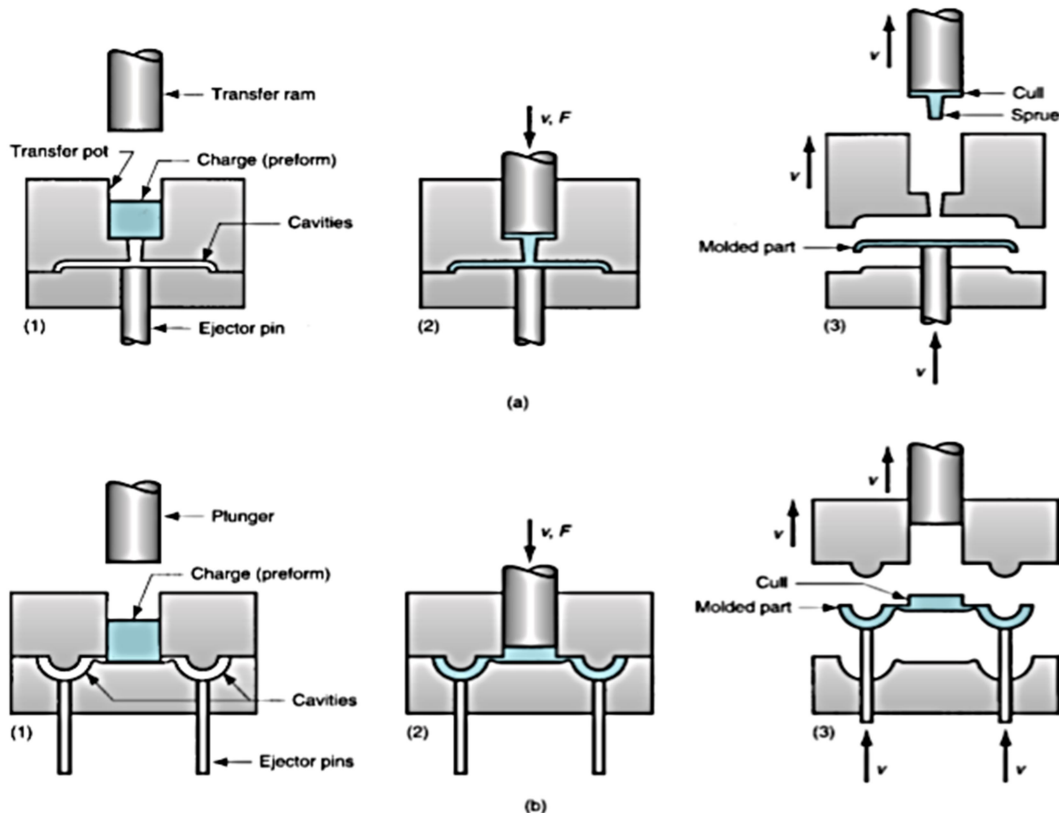


FIGURE 4. (a) Pot transfer molding, and (b) plunger transfer molding. Cycle in both processes is: (1) charge is loaded into pot, (2) softened polymer is pressed into mold cavity and cured, and (3) part is ejected.

(b) **Plunger transfer molding** الصب بنقل المكبس, in which the charge is injected by means of a plunger from a heated well through lateral channels قنوات الأفقي into the mold cavity.

In both cases, scrap is produced each cycle in the form of the leftover material بقايا المواد in the base of the well and lateral channels, called the **cull**. In addition, the **sprue** in pot transfer is scrap material. Because the polymers are thermosetting, the scrap cannot be recovered.

BLOW MOLDING التشكيل عن طريق النفخ

This process is used to make hollow, seamless parts أجزاء السلسلة out of thermoplastic polymers. Parts range in size from small plastic bottles of only 5 mL to large storage drums of 38,000 L capacity. Blow molding is more suited to the mass production of small disposable containers حاويات صغيرة يمكن التخلص منها.

Blow molding is a molding process in which air pressure is used to inflate تضخيم soft plastic inside a mold cavity. It is an important industrial process for making one-piece hollow plastic parts with thin walls, such as bottles and similar containers. Because many of these items are used for consumer beverages المشروبات المستهلك for mass markets, production is typically organized for very high quantities. Blow molding is accomplished in two steps:

- (1) Fabrication تصنيع of a starting tube of molten plastic, called a parison; and
- (2) Inflation التضخم of the tube to the desired final shape.

Forming the parison is accomplished by either extrusion or injection molding.

Extrusion Blow Molding (the cycle illustrated in Figure 5)

In most cases, the process is organized as a very high production operation for making plastic bottles. The sequence is automated and often integrated with downstream المتلقين operations such as bottle filling and labeling. It is usually a requirement that the blown container الحاوية المنفوخة is rigid, and rigidity depends on wall thickness among other factors.

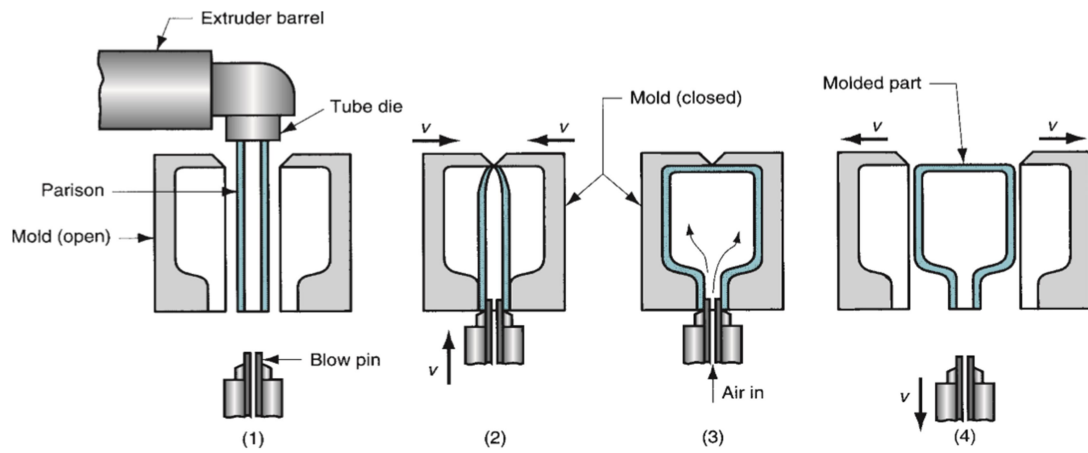


FIGURE 5. Extrusion blow molding:

- (1) extrusion of parison; (2) parison is pinched at the top and sealed at the bottom around a metal blow pin as the two halves of the mold come together; (3) the tube is inflated so that it takes the shape of the mold cavity; and (4) mold is opened to remove the solidified part.

Injection Blow Molding, (A simplified sequence is outlined in Figure 6)

The starting parison is injection molded rather than extruded. Compared to its extrusion-based competitor المنافس, injection blow molding usually has the following advantages:

- (1) higher production rate,
- (2) greater accuracy in the final dimensions,
- (3) lower scrap rates, and
- (4) less wasteful of material.

On the other hand, larger containers can be produced with extrusion blow molding because the mold in injection molding is so expensive for large parisons. Also, extrusion blow molding is technically more feasible ممكن and economical for double-layer bottles used for storing certain medicines, personal care products, and various chemical compounds.

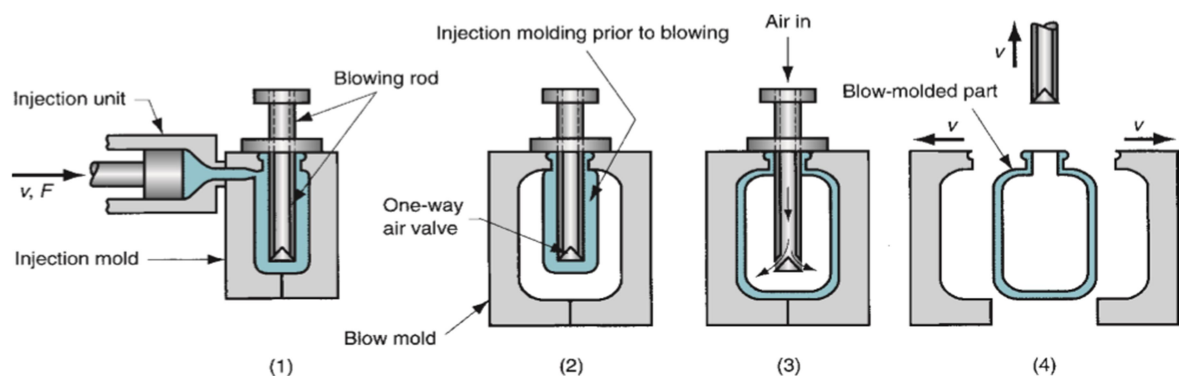


FIGURE 6. Injection blow molding: (1) parison is injection molded around a blowing rod; (2) injection mold is opened and parison is transferred to a blow mold; (3) soft polymer is inflated to conform to the blow mold; and (4) blow mold is opened, and blown product is removed.