APPLICATION BRIEF:

POLYJET FOR BLOW MOLDING

Stratasys®
3D Printers and Production Systems

OVERVIEW

Blow molding makes hollow, thin-walled, plastic parts, such as bottles and containers. Parts with these characteristics are traditionally created by inflating hot plastic so that it conforms to the walls of a metal mold cavity.

Manufacturing these items with metal molds is a rapid and cost-efficient process, but machining the molds requires significant time and cost, and alterations after pilot runs can be problematic. Yet, blow molding companies have largely avoided prototype molding with production plastics because there are few reasonable options, and hollow parts with thin walls are not good candidates for CNC machining. And while 3D printing has become an effective means of evaluating prototype designs, it is not able to fully simulate the properties and appearance of common blow molded plastics such as polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET) and polycarbonate (PC).

APPLICATION OUTLINE

For the two primary methods of blow molding — extrusion blow molding (EBM) and injection blow molding (IBM) — PolyJet™ 3D printing can provide an alternative means of producing prototypes. With only small adjustments to the mold design and molding operations, PolyJet 3D printed molds can produce hundreds of parts in production-grade PE, PP and PET quickly and cost effectively.

PolyJet 3D printing builds plastic objects layer-by-layer, using data from computer-aided design (CAD) files. Combined with the properties of PolyJet materials, it can create high-resolution, smooth surfaces which are ideal for short-run blow molding applications like prototype evaluation and low-volume manufacturing. What's more, the finished parts have the appearance and function of those from a production run. PolyJet blow molds, when used in conjunction with machined injection molds for preforms, will even produce clear bottles in PET on IBM process machines.

PolyJet molds are not intended to be replacements for soft or hard tools used in mid- and high volume production. Rather, they are intended to fill the gap between soft tools and 3D printed prototypes.

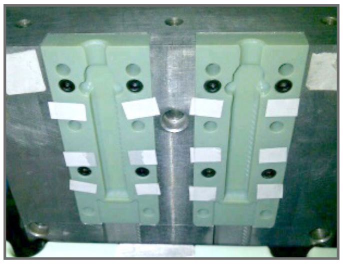
The advantages of PolyJet 3D printed molds over machined molds include significant cost and time savings, enhanced process automation, and greater design freedom. As a result, redesigns are practical and easy to make should a design flaw be discovered.

PolyJet molds have different mechanical and thermal characteristics than conventional tools. As a result, the design of a PolyJet mold and the molding process must be adjusted to address heat retention and lower compression strength issues.

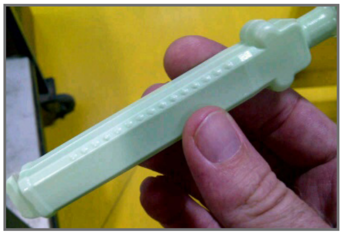
The key design alteration for EBM molds is a larger pinch off. For both EBM and IBM processes, molding temperatures should be held to a minimum and cycle times increased. These changes will address material shrinkage and the problems that arise with an excessively hot mold.

A blow molded bottle created with a PolyJet mold is ready to be reviewed for form and function.

Clear PET bottle produced using a PolyJet mold.



Digital ABS cavity inserts in a mold base.



Plasel's blow-molded polyethylene (PE) packaging for testing.

BENEFITS OF POLYJET

Average lead time savings:

- 85% – 95%

Average cost savings:

- 75% – 95%

Greater efficiency:

- Automated tool-making

Design validation:

- Evaluate form and function.

Facilitates revisions:

- Quickly and easily revise parts and molds

Enhanced quality:

- Match the look of production molded parts.
- Create smooth surfaces.
- Capture fine details in molded parts.

Real material:

- Use spec resin for true to-life functional evaluation.
- Create highly transparent bottles.

POLYJET IS A BEST FIT

Quantity:

- Low volume (1 – 1,000 molded parts)

Processes:

- Extrusion blow molding (EBM)
- Injection blow molding (IBM)*

Materials:

- PP, LDPE, HDPE and PET

Size:

- 1 ml – 1 liter (0.03 – 35 oz)

Design:

- Revisions are likely.

* PolyJet molds are used only for the second stage of IBM.

CUSTOMER STORY

Plasel Precision Plastics, based in Israel, develops and manufactures plastic packaging for technical products. For package designs, its evaluations continue beyond form, fit and function to include assessments that test its performance in automated manufacturing processes.

During the design review of one new package, PolyJet molded prototypes revealed that fastening features were causing misalignment when being conveyed to the shipping department. Designers modified the features to ensure that stacks of the plastic packages retained a vertical alignment, but they needed to confirm that the packages would work with the customer's automated conveyance system.

Plasel chose to blow mold 100 prototypes using a PolyJet 3D printed mold because it was faster and less expensive than CNC machining or making a prototype aluminum blow mold. Both of the processes were estimated to cost $2,500 to $5,000 and take four weeks to create; the PolyJet mold cost $280 to produce and was ready to begin molding parts in just two days.

Using the prototype packages, Plasel was able to confirm that the new design performed perfectly on the automated conveyance line, while also validating its form, fit and function.

How does PolyJet compare to traditional methods for Plasel?

Method	Production Time	Cost
CNC Machining*	Up to 20 days	$5,000
Aluminum Mold	Up to 20 days	$5,000
PolyJet Mold	2 days	$280
SAVINGS	**18 days (90%)**	**$4,720 (94%)**

* 100 finished parts

CUSTOMER PROFILE

Forward-thinking designers and manufacturers of blow molded parts for:

- Functional prototyping
- Low-volume production

Manufacturing characteristics:

- Low volume in production-grade plastic.
- Use EBM or IBM.
- Open to process modification.

Traditional technology obstacles:

- Mold-making for prototypes is cost and time prohibitive.
- No blow molded, functional prototype alternatives.

REFERENCE COMPANY

Plasel PRECISION PLASTICS

Application compatibility: (0 – N/A, 1 – Low, 5 – High)

• PolyJet: Design (4) • FDM®: Idea (1), Design (1), Production (3)

Companion and reference materials:

- Technical application guide
  - Document
- Application brief
  - Document
- Video
  - Commercial
  - How It's Used

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