APPLICATION BRIEF

PolyJet for Jigs and Fixtures

Overview

Jigs and fixtures are vital tools for every industry, used in many different applications. They hold parts for machining and assembly, organize work spaces and are used as guides and templates for inspection (Figure 1).

For every step in the manufacturing process, there is the opportunity to use a jig or fixture to improve operational efficiency, reduce scrap and improve quality. They're usually made for a specific part or assembly, which means that even small businesses will use hundreds of jigs and fixtures to keep production at peak levels. If the manufacturing process has to wait for a jig or fixture, production can grind to a halt. That's why it is critical that they can be made quickly, efficiently and cost-effectively.

Application Outline

Jigs and fixtures are commonly fabricated by machining metal, wood or plastic. When this work is done in-house, it can tie up machine tools used for production work. When the work is subcontracted, lead times can take weeks. Whether they're made in-house or outsourced, jigs and fixtures are subject to the same design-for-manufacturability limitations that govern production work. This can result in designs that are not optimal for the operation.

PolyJet™ 3D printing technology provides a fast and cost efficient alternative for making jigs and fixtures (Figure 2). PolyJet is a 3D printing process (additive manufacturing) that builds objects layer by layer, using data from computer aided design (CAD) files. The automated process eliminates CNC programing, setup and operator oversight to make overnight production and one-day delivery possible.

PolyJet is fast and efficient for even the most complex designs. This allows jigs and fixtures to be optimized for worker comfort, low cycle times and error-proof procedures. Another benefit of PolyJet is its multi-material capability, which can produce jigs and fixtures with a combination of rigid and flexible as well as opaque and translucent features. For example, a PolyJet fixture can have a flexible coating over rigid plastic to provide a non-marring, anti-slip surface or a pliable interface that compensates for manufacturing tolerances (Figure 3).

Figure 1: Printed drill guide (FC720).

Figure 2: Computer mouse (black) and assembly fixture (white) for inserting screws (VeroWhite™).

Figure 3: Assembly fixture (right) has non-marring, anti-slip (black) interface surfaces (FC720 and TangoBlack™).

BENEFITS OF POLYJET

Average lead time savings:
- 60% – 90%

Average cost savings:
- 50% – 70%

Increased efficiency:
- Few operational steps
- Virtually labor-free
- Automated

Improved performance:
- Optimized designs
- Ergonomic designs
- One-piece assemblies

Eliminate secondary operations:
- Integrated rubber-like features
- In-process labeling

Reduced inventory expense:
- Digital inventory - print as needed

POLYJET IS A BEST FIT

Design:
- Complex, intricate
- Moderate to thick walls
- Revisions likely

Operating environment:
- Moderate loads applied
- Reasonable temperatures
- No exposure to chemicals/ petroleum products

Size:
- 25 mm (1 in) to 305 mm (12 in)

Quantity:
- 1 to 100

Multi-material printing can also be used for labeling purposes. Identification numbers, alignment guides or usage instructions can be printed while the jig or fixture is made (Figure 4). This approach to labeling is simple, and the label won't peel, fade or wash off.

Since it is quick and efficient to 3D print jigs and fixtures, companies can shift to a digital inventory concept. Rather than storing these manufacturing tools when they are not in service, simply print out jigs and fixtures as they are needed. This eliminates the time, cost and labor for tool storage and inventory control, as well as time lost trying to locate an infrequently used jig or fixture.

Customer Story

Rutland Plastics, located in Rutland, United Kingdom, delivers custom injection molding services and products to a variety of companies and industries. Many of the manufacturing and inspection operations Rutland performs require the use of jigs and fixtures to hold and position its injection molded parts.

Most of these fixtures are designed specifically for each client's unique parts (Figure 5). This means that Rutland needs a quick, low-cost solution for producing numerous jigs and fixtures, something that wasn't possible with traditional CNC machining. A typical CNC machined aluminum fixture took three days to make and cost $1,500.

Another obstacle was that Rutland was machining its fixtures on the same machines used to make injection molds, and Rutland managers were reluctant to stop production of revenue-generating molds to make fixtures. In addition, identification labels and soft-touch pads had to be added to conventionally-machined fixtures, requiring secondary steps and added time.

As a solution, Rutland engineers took advantage of the multi-material capability of their Objet350 Connex™ 3D Printer, previously used for prototyping, to make jigs and fixtures. This allowed them to quickly produce custom fixtures with a rubber-like interface to prevent marring, and an embedded identification label, all in a single operation.

Carl Martin, technical manager for Rutland Plastics, said, "We can produce jigs and fixtures in a fraction of the time and cost on the Objet 3D Printer, without tying up production machinery." Martin noted that the cost of producing the typical fixture has been reduced to $900 and the lead time dropped to 24 hours. The process is also more efficient since engineers can simply set up the 3D printer and walk away, letting the 3D printer do its work overnight.

Martin added, "Additive manufacturing eliminates the constraints of CNC machining, which makes it possible to improve the productivity of our operations by improving the functionality of the fixtures."

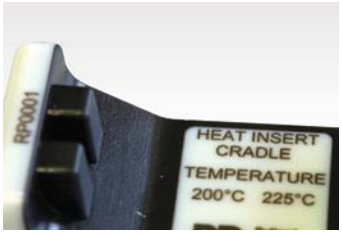

Figure 4: Identification and operating instruction are possible with multi-material printing (VeroWhite and TangoBlack).

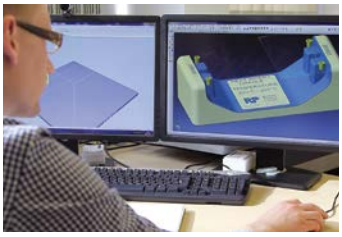

Figure 5: Rutland Plastics engineer designing a heat-staking fixture.

Figure 6: Injection molded part (black) with heat-staked brass inserts rests in a PolyJet multi-material fixture (VeroWhite and TangoBlack).

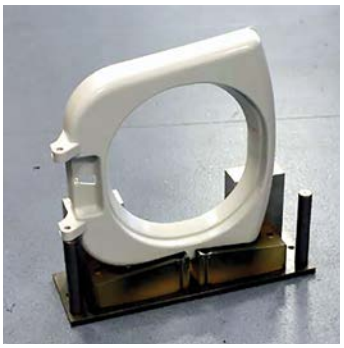

Figure 7: Assembly fixture printed with rigid and rubbery features (FC720 and TangoBlack).

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POLYJET FOR JIGS AND FIXTURES

How does PolyJet compare to traditional methods for Rutland Plastics?

METHOD	COST	PRODUCTION TIME
CNC	$1,500	3 days
PolyJet	$900	1 day
Savings	$600 (40%)	2 days (67%)

CUSTOMER PROFILE

Companies:
- Manufacturers, testing labs and inspection houses with holding or alignment requirements in:
  - Production
  - Assembly
  - Inspection
  - Inventory
  - Transportation

Characteristics:
- Plastic jigs and fixtures are acceptable

Traditional technology obstacles:
- Machining is cost or time prohibitive
- Sub-optimal performance due to design limitations
- Non-critical jigs and fixtures are a luxury

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

- PolyJet™: Design (2), Production (3)
- FDM®: Idea (2), Design (3), Production (5)

Companion and reference materials:

- Technical application guide
  - Document
- Application brief
  - Document
- Video
  - Commercial
  - Success story
  - How It's Used
- Referenced processes
  - Rutland Plastics

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