



## White Paper

# Jewelry Applications Using PolyJet™ Rapid Prototyping Technology

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### ABSTRACT

The PolyJet™ technology has long possessed remarkable potential for jewelry applications. Because rapid and successful growth into new markets requires an understanding of the unique process requirements, market drivers and existing technology synergies, it is important to understand and address the challenges presented by this new market.

This whitepaper provides an evaluation of how Objet PolyJet Technology fits within a jewelry applications framework. We expect the PolyJet technology, specifically the introduction of the process technology, to revolutionize jewelry production and to bring with it additional benefits including labor-cost savings, a shortening of product development time and new design developments.

Objet's family of 3-dimensional printing systems brings high-resolution rapid prototyping (RP) solutions to office environments, including the studios of jewelry designers. Objet's patented PolyJet Technology-based printing systems, which work with Objet FullCure® materials and Objet software, provide a complete 3-dimensional printing solution for virtually any jewelry and fashion accessories application.

### INTRODUCTION

Jewelry designers use Objet's 3-dimensional printing systems as they offer high resolution printing and utilize materials that fit the requirements of this application niche. Objet's flagship line of Eden™ 3-dimensional printing systems offers unprecedented return on investment (ROI) for professional rapid prototyping applications. Printing with the high accuracy of ultra-thin 16µ layers, all Eden systems produce models with exceptionally fine details and smooth surfaces.

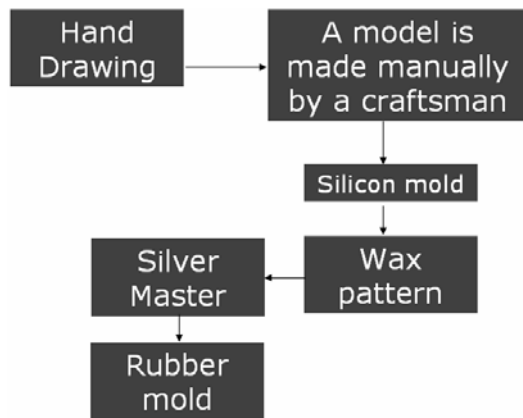
The Eden 3-dimensional printing systems line includes systems designed to address disparate manufacturing needs in terms of build size and productivity and varying budget requirements. Their compact design and clean printing process make Eden systems ideal in any office environment.

Objet's 3-dimensional printing systems have been gaining ground due to their attractive combination of high resolution printing with fast building times. These jetted photopolymer systems can be used to match jewelry requirements, to make jewelry patterns, and to manufacture final pieces.

Eden 3-dimensional printing systems print ultra-thin 16µ layers, producing models with exceptionally fine details and smooth surfaces. As a result of the introduction of Objet's 3-dimensional printing systems, and in particular due to the high accuracy of the models they produce, a revolutionary change in jewelry production processes has occurred: unique items can now be mass produced.

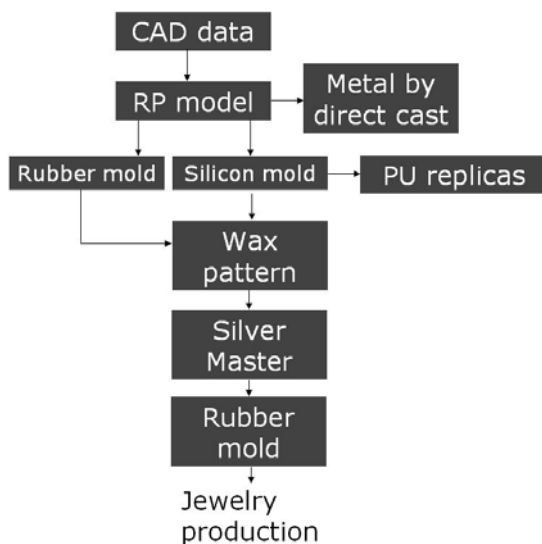
## Jewelry Manufacturing Processes

The traditional jewelry manufacturing process includes six steps:



**Figure 1:** Workflow of a traditional jewelry manufacturing process

When using RP systems in the jewelry manufacturing process, additional steps must sometimes be added, often unexpectedly. For example, a metallic model may be needed because a resinous model cannot be refined smoothly enough, even if worked on directly by a craftsman.



**Figure 2:** Workflow of a jewelry manufacturing process using rapid prototyping

**Silicon molds using PolyJet™ models:** When using RP to produce silicon molds, it is recommended that a wax model pattern be cast after the silicon mold is produced in order to improve the quality of the final product. This

additional step is easy and simple, with a low failure rate.

To produce even higher quality products, a craftsman needs to refine the printed prototype before building the silicon mold.



**Figure 3:** Silicon molds using PolyJet™ models

**Rubber molds using PolyJet models:** The most common use of RP models in the jewelry manufacturing process is to create a rubber mold that is then used to make a master model of the piece to be created.

Rubber molding material is used to create a flexible mold of the master model. A fluid wax is then injected into the rubber mold to create a pattern. Once cooled, the wax piece is removed from the rubber mold.

The wax pattern is then attached to a wax pole called a sprue. The wax pattern and sprue are used to create the void in the castable mold. The assembly of wax patterns and a sprue is called a tree. A tree may contain a short sprue with a few wax patterns or dozens of patterns around a single sprue.

After preparing the trees, the sprue is placed on a rubber base and a cylindrical metal flask is secured around the tree. A plaster-like material, called investment, is used to make the slurry which is poured inside the flasks around the trees. When the slurry has hardened, the rubber sprue base is removed and the mold is ready for the wax removal process. The flask is placed in an oven. With a controlled heating cycle, the investment mold is cured and the wax is completely melted away. A hollow void is left in its place, replicating the wax tree in complete detail.

Molten metal is poured into the sprue opening, filling the void and recreating the original wax

tree with a metal replica. Once cooled, the investment can be cleaned from the metal in a water bath. The jewelry pieces are then cut from the metal sprue and finished to create the desired cast piece.

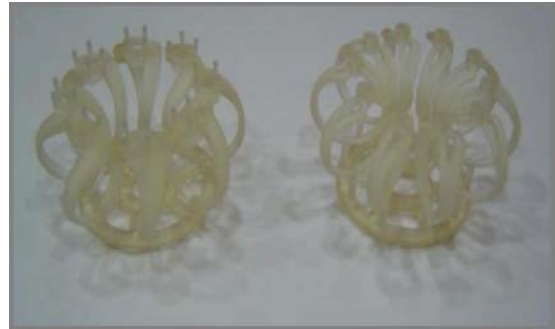


**Figure 4:** Rubber molds using PolyJet models

## FUTURE OPPORTUNITIES

The creation of silicon and rubber molds using PolyJet rapid prototyping technology has already been discussed in this whitepaper. In addition, there are numerous other possible applications, many of them thought of by Objet's 3-dimensional printing systems' users. Each of these possibilities comes with its own set of strengths and limitations.

**Printing a complete tree:** The demand to create master models, build uniform trees and develop additional techniques for investing, burnout and breakout will have to be answered in the future because of their potential to save time in the production phase. Printing a complete tree will reduce the number of steps in the manufacturing process, thus improving turnaround time.



**Figure 5:** Printing a complete tree using Objet's 3-dimensional printing system



**Figure 6:** Examples of jewelry models made by Objet's 3-dimensional printing system