Cast Urethane Rapid Prototyping: Steps to Mass Production

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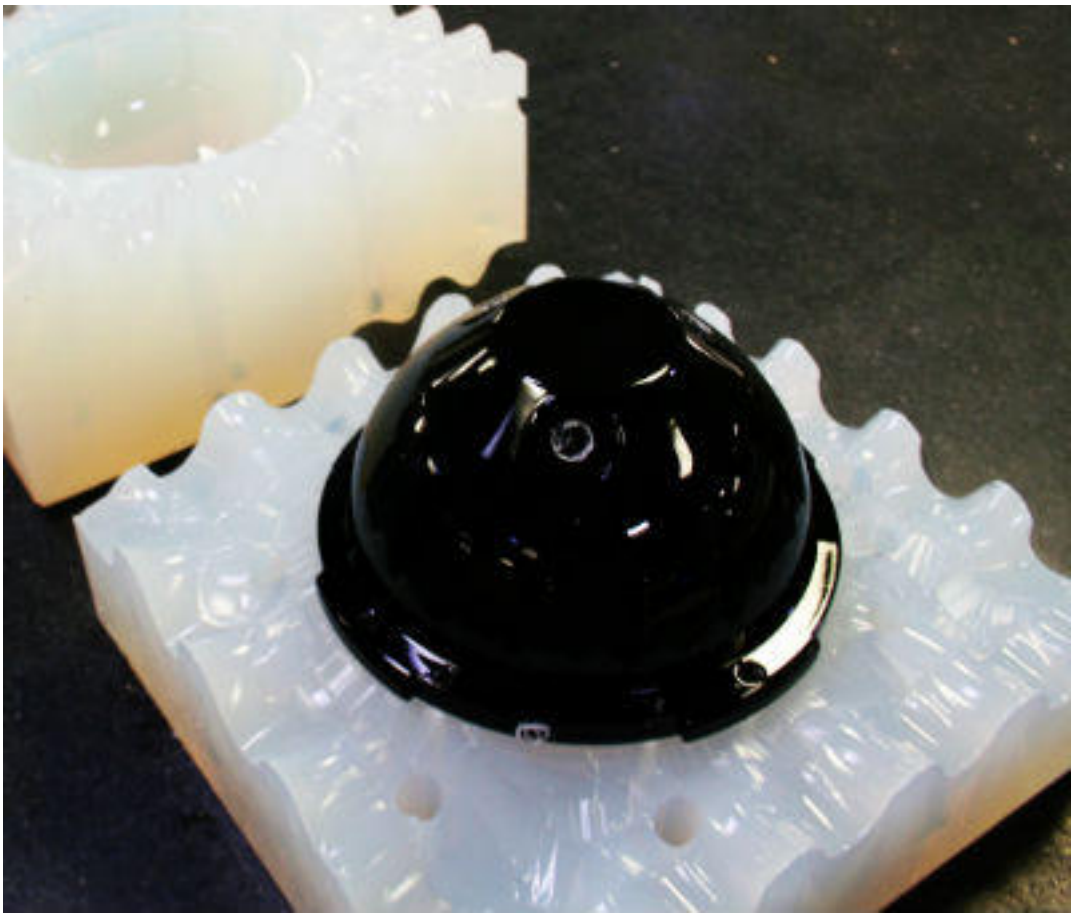
Rapid prototyping must accurately portray what a completed design will entail, and how a completed design will function. The product may even need to mirror injection molded parts. Enter cast urethanes. This article highlights the benefits of using this technology for prototype parts as well as short run productions.



Rapid prototyping with additive manufacturing or cast urethanes allows designers and engineers to check form, fit, design aesthetics, and targeted consumer response with regard to a new product. Cast urethanes use plastics of similar quality as injection molded products. Unlike injection molding, though, cast urethanes use soft tooling, which significantly lowers the cost of production. This factor is why cast urethanes are often utilized for rapid prototyping and low volume production when product need is partly function, partly aesthetic response, and especially time sensitive.

Cast urethanes, such as Solid Concepts' [1]QuantumCast castings, are normally used for short-run productions of prototypes or products—ten to one hundred at most. Designers and engineers often begin with cast urethanes because the intent of mass production may not yet be confirmed, the low volume may not justify hard

tooling, or there is a tight timeline to get a product to market.

The QuantumCast process involves casting reinforced urethanes with vacuum, heat, and pressure to enhance the mechanical properties of the resulting parts. The QuantumCast process begins with a master pattern, around which a mold is formed. The mold is then used to cast parts identical to the master pattern.

Master patterns for QuantumCast molds are often manufactured with the use of additive manufacturing, or 3D printing. Solid Concepts takes a 3D CAD configuration and prints the master pattern using stereolithography (SLA) or PolyJet. Both these additive manufacturing processes are capable of printing in very fine layer resolutions, resulting in highly detailed products.

These additive manufactured master patterns go through a thorough cleaning and hand finishing as the soft tool silicone that will form mold cavities pick up acute elements from the master patterns. A box is formed around the master pattern and filled with a liquid silicone, which quickly hardens. The silicone mold is then carefully cut in half and opened, and the master pattern pops out. The mold is then filled with liquid urethanes, treated under vacuum, heat, and pressure, and the urethane part is removed from the silicone mold. The process repeats.

The silicone molds, reinforced with platinum, allow for the transference of very high detail onto the mold cavity. This makes them excellent for transferring details to the finished products; however, because they are a soft tool, they have a limited life as a mold, usually hitting their peak after 15 to 30 shots. But there is a great deal of speed (a fully completed production run can be completed in as few as three days) and flexibility achieved with cast urethanes, as well as acute surface detail. Compare this to the more complicated steps involved in creating hard tooling and the more involved programming and manipulating process of machining. Additionally, for short-runs of 10 to 100, cast urethanes can be incredibly beneficial.

Short-run productions of cast urethanes can be more cost effective than injection molding while still achieving complex and involved production and prototype parts. For starters, there is no hard tooling involved. The pattern for the mold is often created by a 3D industrial printer and then quickly used to form a silicone mold. Cast urethanes are frequently used in hundreds of industries for the very reason that the market is often unpredictable; investing in hard tooling that costs hundreds of thousands of dollars is risky, and even unnecessary, until clear market interest can be determined. Rapid prototyping with cast urethanes (which double as functional end-use short-run production parts) and additive manufacturing results in significant time to market savings.

Once these functional QuantumCast cast urethanes have helped to assess the market, Solid Concepts seamlessly transfers the production to their tooling and injection molding department for mass production. Sometimes, products are happiest remaining in the lower volumes of cast urethane production because cast urethane processes allow the quantity of products to fluctuate; unlike hard tooling, cast urethanes are not dependent on high volumes.

With the advances in additive manufacturing and their complement to the cast urethane process, there is an amount of relief noticed in manufacturing. Less expensive parts for shorter runs to first garner functionality or demand can often result in far more successful mass production runs.

Links:
[1] http://www.solidconcepts.com