PING Optimizes Its Prototype Injection Molding Capabilities with Additive Manufacturing

PADT Case Study

THE BEGINNINGS OF A GOLF GIANT

Fig. 1: PING Logo

Since its founding in 1959, the name PING has been synonymous with high-quality golf clubs among professionals and casual players alike. While the game of golf is obviously at the core of what it does, the company also has roots in engineering, dating back to its creator, Karsten Solheim, who worked as an engineer at the General Electric company when he started making putters in his garage in Redwood City, California. PING owes a great deal of its success to Solheim's application of scientific principles to golf club design, as at the time, the majority of this work was based largely on trial and error.

With this emphasis on the technical side of its manufacturing, the company has been able to stand out among its competitors through a variety of innovative and data-driven practices. PING was the first in the industry to use investment casting in its manufacturing process, reducing costs and allowing for better quality control on the more advanced features available on some of its clubs. The company was also the first to offer fully customized fitting. It did this by pulling data from its comprehensive multi-step fitting process, which analyzes roughly 100 unique inputs in order to determine the components that will provide the user with the optimal experience for putters, drivers, and everything in between.

IMPLEMENTING ADDITIVE IN A NEW DIRECTION

Always on the lookout for new ways to optimize their workflow, PING recently set out to find new technologies that could be used to further speed up and reduce the costs of its development processes. Additive manufacturing has been used at PING for over 20 years in various capacities, so investigating developments in that field was a logical next step. The company set out to pinpoint specific stages in its process through which implementation would benefit the entire manufacturing organization.

Two of the most relevant uses the team found for this technology were rapid prototyping of injection molded parts and customization of designs. The ability of Stratasys PolyJet additive manufacturing systems to produce small volumes of customized complex parts and structures showed potential for significant savings in both time and cost compared to traditional manufacturing methods. Additionally, PING showed interest in additive's capability of streamlining the company's supply chain through producing various parts and components, including injection molded parts, on-site as opposed to an external factory floor. This eliminated the need for logistics and shipping considerations. All of this considered, PING decided to pursue implementing additive manufacturing within their prototype injection molding process with the hopes of adding flexibility to the product design cycle.

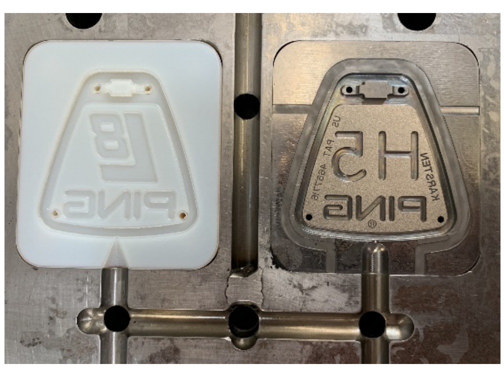


Fig. 2: A 3D printed injection mold compared to a more traditionally manufactured version of the same mold - Courtesy of PING

PERFECTING PRINTED MOLDS

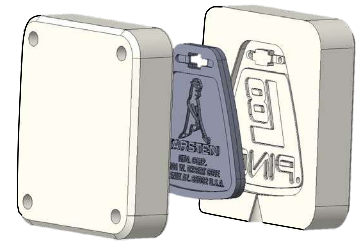


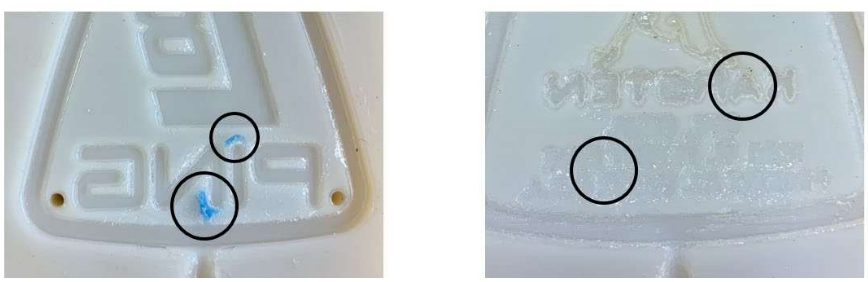
Fig. 3: CAD design of 3D printed injection molding inserts - L8 headcover - courtesy of PING

In order to validate the use of PolyJet technology, the team got to work using it to make inserts for pre-existing master unit die (MUD) sets used to create molds for a variety of prototyped parts, including customized headcover tags for drivers and other clubs. Using the Stratasys Connex 3, PING began printing tools for its injection molding process out of Digital ABS. The molds were printed on the "glossy" settings, with no supports on the injection molding face, and injected with low-temperature materials to help increase the lifespan of the molds and maintain surface quality in the final parts comparable to those created using more traditional injection molding methods.

Parts produced using the first round of PolyJet mold inserts left some room for improvement. After roughly 20 shots, small details in the mold, as well as on the parts themselves, would begin to fade out and deteriorate. With the help of both PADT and Stratasys application experts, PING identified a number of important process changes.

> ***"We have partnered with PADT for two decades on various projects. They have always been responsive to our needs and help us find pragmatic solutions to our design challenges. For additive hardware specifically, they understand the criticality of this equipment once installed. They have aided in finding maintenance and temporary print backup solutions to ensure maximum availability of the equipment and print capability."***
>
> - ***Tyler Shaw, Director of Advanced Manufacturing, PING***

First, aligning the print direction of the mold with the flow of material during the injection molding process helped increase the overall lifespan of the inserts themselves. This fix was as simple as reorienting the geometry of the parts in Stratasys' GrabCAD software prior to printing. Next, the team discovered that cooling the 3D printed inserts as well as reapplying mold release in between shots prevented parts from sticking and made a big difference in maintaining mold quality throughout that extended lifespan. Lastly, more rounds of testing showed that additional improvement would come with an increase in the size of the part details – allowing more space for the injected material to flow evenly – made those features more clearly pronounced across the entire mold geometry.



Material sticking to mold

Small features began to erode and lose resolution

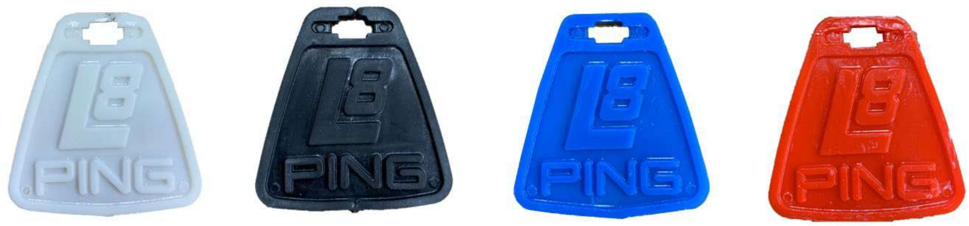
Fig. 4: Examples of degradation in 3D printed parts – Courtesy of PING

LOOKING FORWARD

On top of gaining longer-lasting injection mold inserts and improved aesthetics and surface finishes on end parts, the team at PING found that since implementing additive into this process, its overall lead-time for creating parts had decreased dramatically. Designs can now be taken from concept to reality in a matter of days, as opposed to the weeks that were often required before. This is largely thanks to the higher speed of the company's 3D printer compared to that of tools previously used to create molds, as well as the ability to more quickly iterate on designs thanks to production being done on-site with tools that are highly compatible to those used in the design process.

Going forward, the team at PING envisions that 3D printed injection molds will continue to be useful for prototyping a variety of parts and may eventually be used for small volume production. As the company continues its work of process optimization, there are plans to establish new testing parameters and evaluate a variety of additional characteristics in future iterations.

Regardless of future plans, it is clear that this initial validation of expanding additive manufacturing's use at PING has opened the door for a wide variety of exciting new projects in the years to come.



TPE Hytrel TPE 60A TPE 55D

Fig. 5: Variety of injection molding materials supported - Courtesy of PING

Contact Us:

PADT Inc.
7755 S. Research Dr.
Suite 110
Tempe, AZ 85284
1-800-293-PADT (7238)
or info@padtinc.com
www.padtinc.com