Case New Holland Uses DuraForm and CastForm Materials for Casting

Sector: Automotive
Technology: SLS® system/DuraForm® & CastForm® materials

The Vanguard™ si2™ SLS system (now sold as the sPro 60 SD) from 3D Systems utilizes a CO_2 laser to fuse powder material into solid nylon or polystyrene parts. The finished parts can be used as prototypes or patterns for investment casting.

When agricultural and construction equipment giant Case New Holland (CNH), of New Holland, Pa., wanted to bring solid imaging technology in-house, it performed a thorough evaluation of several rapid prototyping technologies.

The result was that CNH purchased an SLS machine in 1998. Since then, the company has been using it to churn out DuraForm sand casting patterns. These patterns are used to cast metal prototypes and low-volume production parts.

The impressive time savings CNH has achieved using its SLS system has made the investment worthwhile. The company has discovered the benefits of a technology that offers several material choices and a high degree of application diversity. In addition to sand casting patterns, CNH also uses its SLS system to produce sturdy DuraForm prototypes and investment casting patterns.

"Our main goal was to find a system that would help us streamline the creation of sand casting patterns," says Luke Nolt, casting specialist at CNH. "We also wanted a system that we could use for a variety of other applications." Most of CNH's sand cast parts are made of grey and ductile cast iron; others are made with cast steel.

"We had hoped for a system that could bring us broader functionality, and with the SLS system we have what we wanted."
- Luke Nolt, Case New Holland

The way it was
At one time, CNH delegated most of its pattern-making work to service bureaus. Interestingly, none of these companies used the SLS process. Most of CNH's experience with SLS came as a result of its pre-purchase research.

Using a service bureau and non-SLS processes had several drawbacks. First, the patterns and parts were dimensionally unstable and susceptible to moisture. Second, CNH often had to "wait in line" for parts, sometimes alongside the competition.

"These issues helped lead us to the SLS machine and DuraForm material," says Nolt. "The SLS process certainly was not the least expensive option out there, but it offered what we needed, showed the most potential to expand our range of applications, and helped us achieve the accuracy and dimensional stability we were looking for. The DuraForm material also was durable enough to withstand the foundry molding processes."

For CNH, one or two prototypes won't do. Typically, it needs 20 to 50 cast metal prototype parts to complete testing for function and durability.

"At first we weren't sure we could get 50 cast parts from the sand casting patterns we made using DuraForm, but it worked with no problem," Nolt says. "We've even turned about a dozen of these sand casting patterns into low-volume production patterns that have yielded as many 1,200 parts for actual production."

At first, CNH made simple DuraForm patterns that could be built easily in their entirety within the SLS system build chamber. Soon the company moved on to larger patterns, which are built in segments and then pinned and glued together.

"Making these segmented patterns worked pretty well for us," Nolt says. "At first we were concerned that the DuraForm parts might fracture, since the patterns undergo a lot of pressure and abrasion from the sand. But it worked very successfully."

New techniques

Time and experience have helped CNH expand its skills with DuraForm. In addition to split and mounted patterns, CNH sees the benefits of simply making a DuraForm pattern insert. These inserts are mounted into standard matchplates at the foundry. This method has made it easier to create patterns with offset parting lines.

"Sure, we could go out and purchase what we need for conventional pattern-making processes at a comparable cost, but this would slow us down considerably," says Nolt. "Using our SLS system cuts pattern-making time by half or more. It now takes only a few days to do the casting, as opposed to three or four weeks. What's more, the foundries love what we hand them, and they don't have to change their techniques. They are very happy with what the DuraForm material can do. We are essentially making prototype parts with a production process. Ten years ago we were hand-molding most of our prototype parts."

Since the foundry gets involved in the prototype casting phase, it learns how different casting parameters will affect the outcome and characteristics of the production part: how it will cool, how it will act, and so on. Developing the perfect casting process for a part now begins immediately with the prototype.

"When we say we need 5,000 parts, the foundry already knows what the casting process needs to be like because they've already made the prototypes this way," says Nolt. "They can often use the same process with no changes. It's a distinct advantage."

Investment casting with CastForm PS material

In addition to sand casting, which is its primary focus, CNH has expanded into making investment casting patterns. These also are created on their SLS system with CastForm PS material.

"We didn't initially see investment casting as an option, but being able to use it has allowed us to branch out and use investment casting—and we do indeed use it," Nolt says. "Investment casting has allowed us to cast steel parts quickly, which opens up a whole new world of simulated forged parts."

In the past, when CNH needed steel prototype parts it had them machined from a block of steel. The main drawback here is that machined steel parts exhibit different properties and characteristics than those of cast steel parts.

"We are now testing a steel part investment cast from CastForm material," says Nolt. "We don't have to spend money for expensive tooling to have this done."

Direct prototypes

CNH also has used its SLS system to produce DuraForm prototypes of items such as electronic enclosures, control handles and other simulated molded plastic parts.

"We had hoped for a system that could bring us broader functionality," says Nolt, "and with the SLS system we have what we wanted."