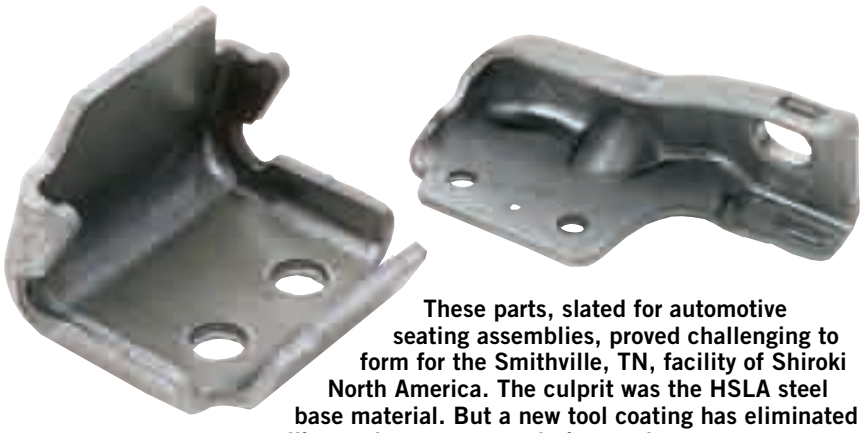
Coating Cuts Galling When Stamping HSLA Parts

A new tool coating eliminates severe galling when deep drawing brackets for automotive seating assemblies, and slashes downtime needed for part rework and die maintenance.



These parts, slated for automotive seating assemblies, proved challenging to form for the Smithville, TN, facility of Shiroki North America. The culprit was the HSLA steel base material. But a new tool coating has eliminated galling and cut part-rework time and expense.

The Smithville, TN, facility of Shiroki North America produces high-strength low-alloy (HSLA) steel parts used in the automotive industry. One such application is the manufacture of seating assemblies and component parts used in motor vehicles. Every year the plant stamps hundreds of thousands of front and rear brackets used in these assemblies. The brackets, stamped out of 590 HSLA, 1.4 to 2.0-mm-thick steel using a progressive die in a 600-ton press, measure 50.8 by 101.6 by 76.2 mm. They undergo a deep draw of 38.1 to 50.8 mm during a tight forming operation.

Shiroki-Smithville has been producing the assemblies for five years, and initially, the deep-draw operation resulted in severe tool galling.

"We were replacing our forms every three or four months," Ernie Dunkley, tooling assistant general manager, explains. "We also were polishing them after every run. The results were unnecessary rework and sorting. To correct this problem, we implemented several kaizens."

Three-Step Approach to Eliminate Galling

"The first step we took was to evaluate the type of lubricant used," Dunkley says. "We switched to a lubricant specifically formulated for high-strength steel and had some success, but we still focused on continuous improvement. Next, we evaluated the coating used on the tools. After a couple of tries, it was in this area that we had the greatest success."

Initially, the company tried a thermal-diffusion (TD) coating.

"We had prior experience using that type of coating but in this case it didn't work out," recalls Dunkley. "Just like the lubricant, the coating provided some benefit, but not enough. After changing the lubricant and applying a TD coating to the tooling, we saw an improvement of about 50 percent."

Personnel still had to inspect a percentage of the parts.

"The TD coating started out doing a good job but didn't hold up to expectations," Dunkley says. "We'd start out with the new coated tooling and the first one or two runs we'd hardly have any issues. But then, after two or three runs, we started to see galling and had to go back to inspecting parts as before. We're talking about 6000 parts per run, so after running 12,000 to 18,000 parts with the TD coating, the tooling began to gall and we had to resume reworking the parts."

The next step: Try another coating.

Quick Coating Turnaround, No Rework

Dunkley and Mike Holt, Shiroki North America toolroom supervisor, attended the Precision Metalforming Association METALFORM show in Nashville this past March specifically to

This strip progression shows the work necessary to produce the seating bracket. The stress of deep drawing this part meant frequent tool polishing. Switching lubricant provided some measure of success but a new tool coating brought much bigger benefits. For example, a prior tool coating enabled production of 12,000 to 18,000 parts when the tooling began to gall and Shiroki North America had to rework the parts. But in the six-month period after the company began using a new coating, the tooling has produced about 120,000 pieces with the coating still in good condition and no need for part rework.

look for coatings that might be able to solve the galling problem when producing high-strength-steel parts.

"It just so happened that at the time we had a new die to produce a door part, on which we really had to expedite lead time," Dunkley says. "We stamp the part here and ship it to our Georgia facility for door assembly. We were going to coat the die with a TD coating, but this required a two-week turnaround. Customers wanted us to reduce the lead time and have the die ready as soon as possible."

Dunkley and Holt discussed the issue with Phygen, Minneapolis, MN, a coating company exhibiting at METALFORM.

"Phygen was able to promise us a three-to-four-day turnaround," says Dunkley. "It picked up the form, applied its FortiPhy PVD (physical vapor deposition) coating, and had it back to us in three days. Best of all, the coating worked extremely well."

Based upon that experience, Dunkley and Holt decided to apply the FortiPhy coating on the bracket dies, with excellent results.

"I had the forms coated and let the toolmakers in the toolroom tell me if it was a success," Dunkley recalls. "Our tooling people have been very impressed with the coating—it took a lot of pressure off of them. We had the form coated in mid-2006, and haven't replaced the form yet. Now, when we finish a run and send the tooling to the toolroom, we don't even have to polish it. We just wipe it off and send it back to the pressroom. During the six-month period since we've had it coated, the tooling has produced about 120,000 pieces. The coating is still in good condition and we have not had to do any rework on the brackets produced with those coated dies."

The FortiPhy CrN coatings are applied via a patented plasma-acceleration process, according to Phygen officials, delivering a more energetic plasma than typical to create a coating that consists of nano-sized particles. This, they claim, produces a more uniform, nanocrystalline microstructure that increases coating toughness. In addition, lower processing temperatures keep critical part dimensions within tolerance, meaning less rework.

Less Maintenance and Downtime

In addition to eliminating 100-percent inspection of the brackets, according to Dunkley, Shiroki has saved a significant amount of die-maintenance time as well as downtime—not only in the pressroom, but also on the assembly line.

"We run on a just-in-time basis," he explains, "so if we run a part that we have to rework and/or sort, we could be running so close that the assembly line might have to be shut down because we don't have any parts to supply it. This means that we would have four or five people waiting for parts and the cost of this lost time adds up quickly."

Part rework and sort savings can amount to several thousand dollars per month, Dunkley estimates.

"We've significantly reduced this cost," he says. "It used to be our number-one cost item."

The coating has proven durable, even in atypical situations.

"On the new die for the door-frame part, which Phygen coated for us in just three days, we inadvertently double-stacked that form and were all just horrified," Holt says. "We sent a toolmaker to the press to look at it and the first words out of his mouth were, 'I think the coating broke down.' But after we took the die to the toolroom and wiped off the forms, we found that the coating was fine. So even with a double-stacked part, the coating held up. A lot of coatings would have been ripped right off."

More Tools Slated for Coating

"We've begun to coat other dies with the FortiPhy coating and we're seeing similar results to those we've experienced with the bracket tooling," Dunkley says. "We continually are on the lookout for better ways to do things. For instance, we have a restrike station on this job and we are going to go ahead and coat that, too. Overall, the benefits we've seen with the coating on the bracket dies include an improvement in part quality, reduced downtime on both the press and production lines, and greatly reduced tooling cost." **MF**

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