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High-performance coating helps stamper fight downtime

Dies last longer, need no regrinding

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No production stamper likes to have press downtime. It simply costs too much money. For this reason, progressive stampers invest quite a bit of time, money, and energy in finding ways to fight downtime and to make their presses as productive as possible.

Omni Mfg. Inc. is one such stamper. A mentality of continuous improvement permeates the entire business, including the toolroom that manages the hundreds of dies working in its 68 stamping presses.

The toolroom staff doesn't merely look for better ways to design the tools it builds and keep the dies in good repair. It helps in the fight for productivity in another, more direct way. The toolroom staff has about 5 percent of the dies in its inventory coated to prevent the galling and heating that occur during severe draws. It also relies on coatings to improve the performance of certain pierce punches.

"Typically, we look to coat anything that has a deep draw, does a lot of forming, or forms stainless steel," said Bob Prater, toolroom manager. In some cases, such as forming stainless steel, coatings are mandatory for forming the part properly and achieving an appealing cosmetic appearance.

As one of Omni's presses forms the heavy-duty door hinges, a transfer mechanism advances the workpiece to the next station in the die. Because Phyge's FortiPhy™ UltraEndurance™ coating on the four forming inserts inhibits galling and metal pickup, the four inserts last for nearly 200,000 hits, which is approximately 43 percent longer than a CVD TiC coating would last on the same tool steel.

The coatings provide a hard, slick barrier that not only protects the die's surfaces from wear, but also enhances flow of the steel as it deforms against the die. The slickness of the coating reduces the friction that can cause bits of workpiece material to become welded to the tool. Because the tool picks up these tiny bits of workpiece material, tool- and diemakers refer to this process as pickup, which can result in workpiece galling, scoring, and scratching.

Materials such as stainless steel and aluminized steel are prone to this phenomenon and often receive ugly blemishes as a result. However, coatings inhibit the abrasion and welding that result in pickup. This, in turn, reduces a die's downtime. Operators can run dies longer before having to stop the press for tool maintenance.

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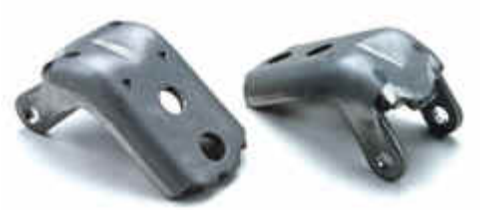
Productivity Hinges on Press Uptime

Omni had a particularly stubborn application in cutting and drawing heavy-duty door hinges from 5-mm-thick, high-strength, low-alloy steel—a project that originally had been contracted to another stamper. The die for this application required frequent reconditioning. With the carbide-based thermal diffusion (TD) coating that the previous stamper had been using, the form inserts in the die lasted 20,000 to 25,000 hits before they needed to be recoated.



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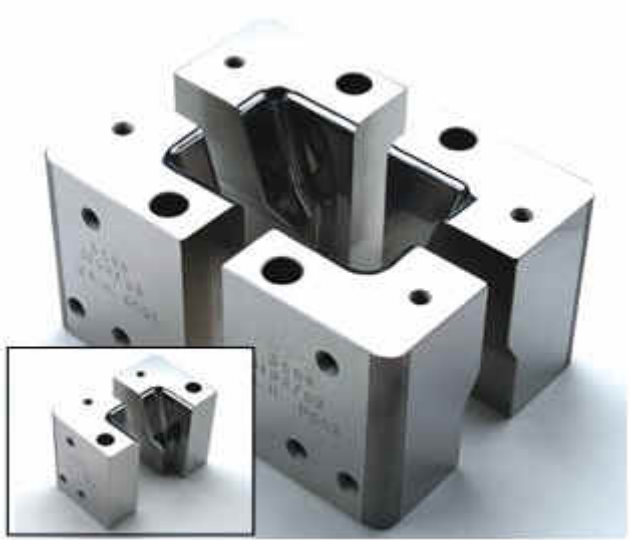
“In my mind, that wasn’t an acceptable number,” said Prater. He thought that the coatings should last at least 100,000 hits.

To test the coating, Prater bought a bar of DC53 from International Mold Steel Inc. and made two sets of inserts from it to conduct a controlled study that compared the performance of the new coating with the conventional TiC coating on this unfamiliar grade of tool steel.

“All of the DC53 came from the same bar,” said Prater. “They [the test inserts] were heat-treated at the same time and processed in the same way.” The only difference was that the two sets went to different coaters to receive their respective coatings.

Although both substrate-coating combinations improved tool life substantially and more than met Prater’s performance goal, FortiPhy outperformed the TiC coating by 43 percent. It lasted approximately 199,000 hits, whereas the CVD TiC coating lasted 139,000 hits.



Omni had this set of four forming inserts stripped, polished, and recoated with Phygen’s coating. The coating has the adhesion and wear resistance of CVD processes, but because it is applied at a relatively low temperature, it does not distort the tooling. This characteristic lends itself to recoating the tooling over and over again.

No Grinding Necessary

Not only did the longer-lasting coating reduce downtime by allowing the die to run longer between reconditionings, but Phygen’s PVD process also did not distort Omni’s die inserts. A distorted insert requires grinding to get it back to its original shape.

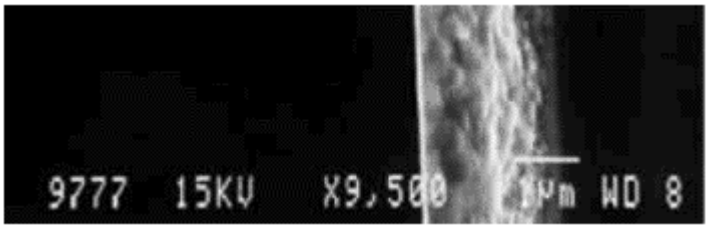
“Anytime you have blocks that fit together, you have only a thousandth [of an inch] or so to play with,” Prater said. Despite the limitation, the inserts fit in the die after the coating process and conformed to the print.

This had been a persistent problem for Omni. “If we’d send out rings, for example, for coating, they’d come back too big, egg-shaped, or too small,” said Prater. “So we would have to regrind them back into shape.”

The coating has a single-phase, nanocrystalline structure that provides the cohesive strength and coating density to withstand the constant pounding and extremely high physical forces inherent in metal stamping. The hard, dense coating also has a coefficient of friction less than 0.1, allowing it to emulate a lubricating agent.

Phygen’s cooler PVD process eliminates the tendency for tooling to become distorted. “We temper our tool steel at roughly the same temperature that Phygen applies its coating,” Prater said. “So, theoretically, the stresses are relieved.”

How Many Hits?



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Despite the benefits that his controlled study has documented, Prater has enlisted Phygen's help in running another battery of tests. The first of these tests will help Omni determine the optimal number of strokes that the door hinge die can run the coated inserts before pulling them for reconditioning.

"I think that the press operators ran [both sets of dies] maybe 10,000 pieces more than they should have" in the first study, Prater said. Although the results showed the new coating/ substrate combination exceeded his goal by nearly 100 percent, he wants to determine the right number of hits for production to use as a guideline for sustained use.

Two other experiments are pending. One is testing the coating on a tool for producing an exhaust resonator, and the other is testing it on some deep-drawing rings for manufacturing stainless steel bushings for front-end suspension units.

Management at Omni puts great stock in such dividends and invests heavily in finding more productive ways of stamping better parts. In fact, it credits these gains and others from continuous improvement programs as crucial to the company's growth throughout the past few years when many of its competitors closed their doors.

"We like new technology," Prater summarized. "We're fairly aggressive about trying new things."

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