Metal Forming Success Story

Phygen℠
Surface Enhancement Performance Leader

Precision Metal Stamper Switches from Carbide to Phygen FortiPhy℠ UltraEndurance℠ Coating on DC53

The Bottom Line

Toledo Technologies Inc. relies on the combination of Phygen's FortiPhy℠ coating and DC53 instead of carbide, for a faster turnaround on replacement tooling and reduced die repair and downtime from failed carbide tooling.

The Numbers

With carbide tooling:

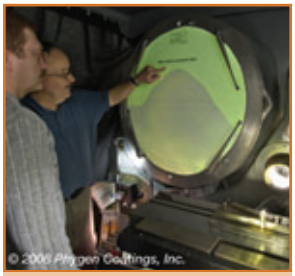
6-8 week turnaround for replacement tools and long downtime from failed tooling

With FortiPhy coating:

1 week turnaround and reduced die repair and downtime

Headquartered in Westland, MI, GT Technologies is a supplier of valve train component systems for automotive applications, commercial diesel engines, and performance racing engines. Its stamping facility in Toledo, OH, Toledo Technologies, produces rocker arms and finger followers on high-speed transfer presses.

According to Terry Giesige, Senior Manager of Metal Forming, the Toledo stamping facility has been in operation since 1931. "We have 21 high-speed presses and our typical production job can run anywhere from six or seven million pieces per year, to 20 or even 25 million pieces per year," Giesige explains. "We have a lot of experience when it comes to meeting critical specifications."



Terry Giesige, Senior Manager of Metal Forming (left), and Larry Webb, a Buyer at Toledo Technologies, examine valve train components produced with tooling that has been coated with FortiPhy℠ UltraEndurance℠ Coating from Phygen Coatings, Inc.

"We have a number of areas on parts we form where we coin the part to control metal flow," Giesige continues. "We're on a just-in-time program with our customers, which determines how we schedule our press room. On average, we run a particular part weekly. But, with the automotive industry, requirements are changing all the time."

Larry Webb, a ***Buyer*** for Toledo Technologies, is an experienced tool & die maker and has been involved in certification of tooling. He's also served as production manager. "Just like everybody else, we're always looking for longevity in a part program, along with making it as cost effective as we can," Webb reports. "We were using a particular type of carbide tool to produce our parts because of the material's hardness and the metal flow required during forming."

Turning Away from Carbide

Webb says they began using DC53, which is a highly refined grain structure and allows for higher draw temperatures over D2. It is an upgrade over D2. "We also were directed to Phygen Coatings, Inc., in Minneapolis, MN, and were told that Phygen's FortiPhy℠ UltraEndurance℠ Coating used on DC53 would outperform carbide," Webb explains.

"I wouldn't say the performance of the Phygen coated DC53 tooling lasts any longer than carbide, but a major benefit of using it is that we can replace it and have our tool coated and back in a week. With carbide, we were looking at six to eight weeks, or maybe even ten weeks to replace a tool."

"What we're doing is an unusual coining process in the die," Giesige explains. "We actually coin directly into the edge of the steel through the shear and the break.Yet, one of the key characteristics of our end product is its surface finish. The combination of DC53 and the FortiPhy UltraEndurance Coating gives us the ability to hold the part to between a 0.5 to 0.9-micron surface finish. This is an important factor in the functionality of the part."

"We were looking for a solution to our problems," Webb says. "Other coatings did not give us the results that Phygen's FortiPhy Coating did. With other coatings, surface finish of the part was not what we wanted. When we coat the DC53 with the FortiPhy Coating, lubricity is a lot higher than with any other coating."

"The only other system that would do the job for us was carbide," Webb adds, "but carbide was just impractical to use because of the long lead time and because of carbide's tendency to break. With carbide, if something is formed in an up and down motion, and there is any side play at all, it's going to break the tool."

Benefits Have Been Significant

Terry Giesige (left) and Larry Webb check out the dimensional tolerances possible with Phygen PVD coatings applied at a lower temperature to eliminate tooling distortion. FortiPhy high density CrN coating also offers a very low coefficient of friction that provides exceptional metal forming performance.

"Fast turnaround in obtaining replacement tooling, quality and dimensional accuracy of the stamped parts, and reduced die repair and replacement downtime caused by failed carbide tooling are major benefits of FortiPhy coated DC53 over carbide tooling," Giesige says. "Because we're running millions of parts, the fewer tooling changeovers we need, the better off we are."

Metal Forming Success Story: Toledo Technologies

These high-tolerance valve train components are produced by Toledo Technologies on high-speed transfer presses equipped with tooling that has been coated with FortiPhy℠ UltraEndurance℠ Coatings.

"Press downtime also could be a factor if we were using carbide," Webb adds. "Carbide does a nice job of forming the part, but it breaks with enough frequency that we've eliminated it from our tooling altogether. In addition, with carbide we'd break a die section but we wouldn't catch it until bad parts began to show up later in the manufacturing sequence. We could generate a lot of scrap and lose a lot of production time before we discovered there was a problem."

"Beyond running production, prototyping and development is a big part of what we do here," Giesige observes. "We're using the Phygen coating and DC53 combination a lot more in our prototype tooling because of the quick turnaround and the quality — primarily surface finish requirements. A lot of the time, our prototypes go through a pretty rigorous testing cycle to validate design. Even one week can make the difference between getting a new customer and missing the deadline."

FortiPhy UltraEndurance Coatings at a Glance

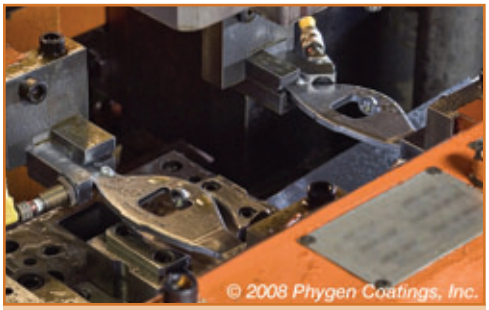
FortiPhy UltraEndurance surface treatment from Phygen Coatings, Inc., results from using a patented plasma acceleration process to apply UltraEndurance coatings. This process increases coating durability and toughness while reducing friction and wear. FortiPhy, a high density CrN coating, also exhibits superior adhesion, structure, uniformity, and density.

The Phygen process delivers a more energetic plasma to create a coating that consists of nano-sized particles. This produces a more uniform, nanocrystalline microstructure, for tougher coatings and better adhesion. Lower processing temperatures keep critical part dimensions within tolerance, for less rework. Extremely good process control and management of coating thickness allows Phygen to custom-tailor coatings for specific applications.

Prototype Production — A Case In Point

Because TiN and TiCN coatings did not make the grade, Toledo Technologies called Phygen for something better. Using EDM to sharpen the worn tools, Toledo hand-polished them to a better-than-average surface finish, and sent them to Phygen. Thanks to quick turnaround, they soon had the newly coated tooling installed and ready to run.

With FortiPhy UltraEndurance coated tooling, Toledo Technologies was able to run the production contract in five weeks. An additional benefit was seen toward the end of the prototype stamping run. Observing how smoothly the process was running, the manager of stamping design, decided to experiment with lubrication. They reduced the lubricant supply by 25 percent and saw no difference in part quality or tool wear.



Precision rocker arms move through this high-speed transfer press at Toledo Technologies in Toledo, OH. High part tolerances are maintained by using D53 tooling components coated with FortiPhy UltraEndurance Coatings from Phygen, Minneapolis, MN. Coated D53 die steel performs equal to or better than carbide without the long lead-time and breakage risk associated with carbide tooling.

In a prior experience, Toledo Technologies was searching for an alternative to carbides in order to make their production processes less dependent on fluctuating carbide supplies. They tried DC53 tool steel, hardened to its maximum of 63-64 Rc. When they had the DC53 punches coated with Phygen PVD, they wound up with punches comparable to, or better than, carbide punches, at half the cost.

In this application, the cheaper and more readily available replacement material was measurably better than carbide. Where double-coated TiN and TiCN carbide tools had produced only 135,000 parts, the Phygen-coated tool steel punches produced 215,000 parts.

The key to FortiPhy UltraEndurance Coatings' exceptional toughness, low coefficient of friction, and superior adhesion is its uniform, nano-crystalline structure. Phygen's patented plasma acceleration process improves upon traditional PVD methods to produce the most uniform coating deposition layer possible, with exceptionally high adhesion. Having solved the uniformity problems inherent in the PVD processes of the past, Phygen can apply denser coatings without voids and macro particles, which can outperform thicker, less-uniform coatings. In addition, FortiPhy Coatings are applied at half the temperature of hot processes to keep critical tool dimensions within tolerance, without the costly rework of hot processes.

Longer Tool Life with Recoating

Unlike hot-processed CVD or TD coatings that combine with carbon molecules in the substrate to form a hard layer, FortiPhy UltraEndurance Coating is a chemically complete coating, applied to a surface using a special high-adhesion process. Typical CVD and TD coatings are applied at temperatures greater than 1800°F in order to increase bonding to the substrate.

During the hot-coating TD and CVD processes, carbon molecules migrate to the surface and combine with the coating material to form a third compound. This can produce a hard coating, but there are drawbacks. Only a small portion of carbon molecules in the substrate are available to migrate to the surface, and they can travel only a short distance. This means that as tools and coatings wear, the second application of these coatings usually lasts about 70 percent as long as the first application. A third application generally has a life of only 30 percent that of the original tool. When no additional carbon molecules can be leached to the surface, the process ceases to provide any benefits.

FortiPhy UltraEndurance Coating does not require molecular action within the substrate to build a hard coating. The patented Phygen PVD process, with its unprecedented level of process control, applies a chemically complete layer of nano-sized particles onto the surface. The FortiPhy Coating does not require carbon or any other molecules from the substrate. This means that every re-coat of FortiPhy Coating has the same toughness, and lasts just as long, as the first. Tool life is extended, and the chemical composition of the substrate remains the same, regardless of rework.

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