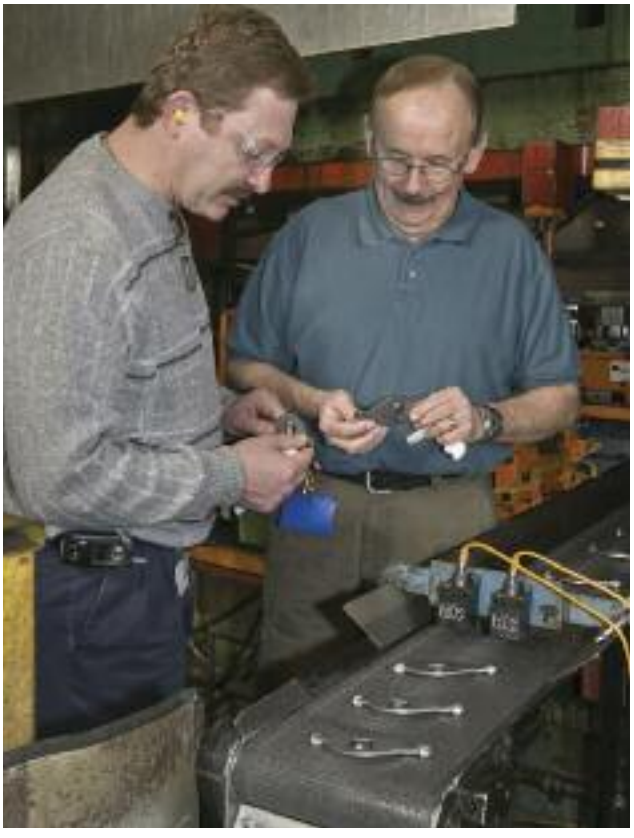
Stamper Replaces Carbide Tooling with Coated DC53

Application of a high-performance tool coating combines with an upgrade in tool steel to deliver a host of benefits to metalformer Toledo Technologies, including improved surface finish of coined parts and minimized die wear.



Toledo Technologies' Terry Giesige (left) and Larry Webb examine valve-train components stamped with tooling that employs coatings applied at relatively low temperatures to eliminate distortion, bringing a host of improvements.

GT Technologies, Westland, MI, supplies valve-train components and assemblies for automotive engines, commercial diesel engines and performance racing engines. Its Toledo Technologies stamping facility in Toledo, OH, produces rocker arms and finger followers on high-speed transfer presses.

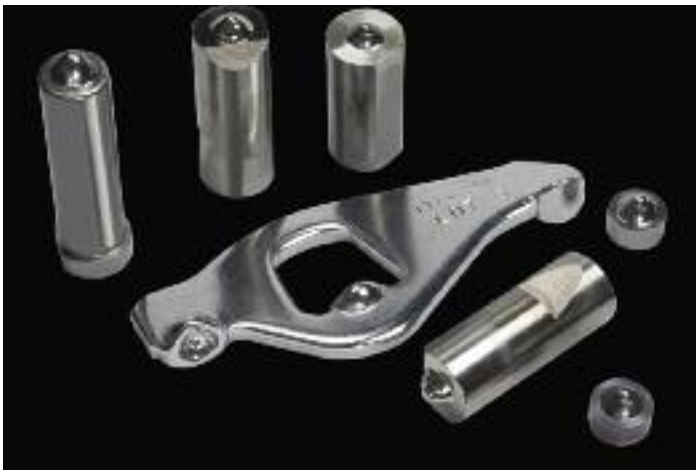
According to Terry Giesige, Toledo Technologies' senior manager of metalforming, the stamping facility operates 21 high-speed presses and its typical production job can run from as little as six to seven million pieces per year to as many as 20 to 25 million pieces annually.

"A number of the parts we form include features that require us to coin the part to control material flow," Giesige says. "We're on a just-in-time program with our customers, which determines how we schedule our pressroom. On average, we run parts weekly. But with the automotive industry, requirements change all the time."

Carbide-Tool Replacement Taking Too Long

Larry Webb, a buyer for the stamping firm, adds that, "Just like everybody else, we're always looking for longevity in a part program, along with making it as cost effective as we can. We used to employ carbide tooling to produce our parts because of the material's hardness and the material flow required during forming. But with carbide, we were looking at six to eight weeks, or maybe even 10 weeks, to replace a worn tool. And, carbide tools tend to break prematurely if there is any side play in the press."

To more quickly replace worn tools, the firm switched to tools made of DC53 (an advanced wrought cold-work die steel from International Mold Steel,



Toledo Technologies stamps these valve-train components on high-speed transfer presses equipped with DC53 tooling high-density durable coatings.

Florence, KY, that has a highly refined grain structure and allows for higher drawing temperatures than does D2), coated with a high-performance surface coating provided by Phygen Coatings, Inc., Minneapolis, MN. Phygen coats Toledo Technology tooling with its FortiPhy UltraEndurance coating.

"We're now able to replace a tool and send out a worn tool and have it coated and back in a week," says Webb.

"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 high-quality surface finish. The combination of DC53 and the lubricity of the Phygen coating allows us to hold the part to a surface finish of 0.5 to 0.9 microns, important to the functionality of the part."

The FortiPhy UltraEndurance surface treatment employs a patented plasma-acceleration process that improves on traditional physical-vapor deposition, says Phygen, to increase coating durability and toughness while reducing friction and wear. The coating also exhibits good adhesion, structure, uniformity and density, and a uniform, nanocrystalline microstructure. Also, minimized processing temperatures (950 F) keep critical part dimensions within tolerance, to minimize rework.

Significant Benefit

"Quick 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, have proved to be major benefits of the coated DC53 tools compared to carbide," Giesige says. "Because we're running millions of parts, the fewer tooling changeovers we need the better off we are."

"Press downtime also was a factor when using carbide tooling," 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 the problem."

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

Prototype Production—A Case In Point

To explain how the switch to FortiPhy UltraEndurance-coated tools improve productivity, Giesige and Webb describe a tough challenge faced by Toledo Technologies several years ago: Quickly stamp 24,000 rocker arms made of 0.118- to 0.121-in.-thick Type 1008 cold-rolled steel in a prototype runoff. Using single-hit dies coated with TiN and TiCN, the firm had to stop production to polish and recoat tools after every 100 parts.

Because standard TiN and TiCN coatings did not make the grade, the

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, the Phygen 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 to increase molecular activity within the substrate. During these hot-coating 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 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. So, 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 coatings, according to Phygen, applied at half the temperature of CVD and TD coatings, do not require molecular action within the substrate to build a hard coating. Instead, the process applies a chemically complete layer of nano-sized particles onto the surface, and does not require carbon or any other molecules from the substrate. This means that every recoat has the same toughness and durability as the first. Tool life is optimized, and the chemical composition of the substrate remains the same, regardless of rework.

Precision rocker arms move through a high-speed transfer press at Toledo Technologies. A new tool coating has boosted part production and reduced lube use.

pair says, Toledo Technologies sought something better. Using EDM to sharpen the worn tools, Toledo hand-polished the tools to a better-than-average surface finish, and then sent them to Phygen for coating.

With FortiPhy UltraEndurance-coated tooling, the firm ran the production contract in five weeks. Toward the end of the prototype job, observing how smoothly the process was running, the manager of stamping design decided to experiment with lubrication, reducing lubricant supply by 25 percent. To his pleasant surprise, he witnessed no change in part quality or tool wear.

In yet another case, Toledo Technologies went in search of an alternative to carbides in order to make its production processes less dependent on fluctuating carbide supplies. It tried DC53 hardened to its maximum of 63-64 Rc and, after coating the punches with Phygen's FortiPhy process, it wound up with punches comparable to or better than carbide punches, at half the cost.

Better yet: while carbide tools double-coated with TiN and TiCN had produced only 135,000 parts between maintenance cycles, the Phygen-coated DC53 punches produced 215,000 parts.

MF

This article was supplied by Phygen Coatings, Inc., Minneapolis, MN: Tel. 888/749-4361, www.phygen.com.