

Molding a Niche

Moldmakers represent a challenging niche market for the cutting tool industry.



Milstar LLC

When it comes to the business of making molds for plastic-injection or forming applications, moldmakers need speed, precision and consistency to be competitive. And, unlike production tool and die shops, moldmakers face the challenges of cutting extremely complex shapes. In addition, they utilize high-speed machines and unattended machining technology to reduce labor costs.

To them, the integrity of the cutting tool is absolutely critical to maintaining the integrity of the cut.

Olav Bradley, president of PM Mold Co., Schaumburg, Ill., said that moldmakers use diamond-coated cutters to make electrodes, which typically have very contoured surfaces because they contain all the details of the mold's cores and/or cavities. "We have a carbon-milling machine that is capable of running up to 65,000 rpm and nothing but diamond holds up under those speeds," he said.

Although the cost of diamond tools is high, the quality and integrity of the cut is maintained and the tool life is much greater. "We can run [the diamond-coated cutters] a lot faster and save a lot in machining time, as well as setup and tool-changing time," noted Bradley.

His shop recently cut 120 detailed, contoured electrodes using basic diamond-coated cutters. He stressed the fact that consistent quality was maintained throughout the run. "It made a world of difference for us," he said. "The last electrode looked as good as the first, and the cutter looked like new."

Terry Colbert, president of JK Molds Inc., Upland, Calif., told a different story. He has a high-speed graphite-milling machine from Roku-Roku that can impart a 600-paper finish. "The machine has the accuracy and the technology, but the cutters don't hold up," he said. "That's the only drawback."

It's a big drawback, though, as it prevents JK Molds from running the equipment unattended 24/7. The cutters wear and break, which drives up labor costs, as the machine must be attended to. This makes it less efficient than other equipment JK runs.

Colbert applies diamond cutters, yet he's limited by size, since cutters measuring 0.010" to 0.012" in diameter are unavailable. It's difficult to find cutters for machining intricate graphite electrodes,

said Colbert.

Trace Jacobs, a product manager in Phoenix for Iscar Metals Inc., concurred. "The graphite-machining industry has always been difficult," he said, adding that there is ongoing research and testing to address the needs of those who machine the material.

Winning the Trifecta

Three critical components of the moldmaking process are the machine tool, the cutting tool and the workpiece material. "Some take the cutting tool and material for granted," said Ron Field, vice president of applications for toolmaker Millstar LLC, Bloomfield, Conn. "We're in the process of educating customers, and the machine tool companies, that a cutting tool's effectiveness is in direct relation to the material it's cutting and the machining process being used."

Field noted that machine tool companies are touting higher cutting speeds and feeds. "But, you need a cutting tool that accommodates the material," he said. "Having a machine that can run fast doesn't mean you'll necessarily run fast. You have to have cutting tools that can hold up to these feeds and speeds. And, the operator must know how to use the tool properly to get the required surface finish and accuracy."

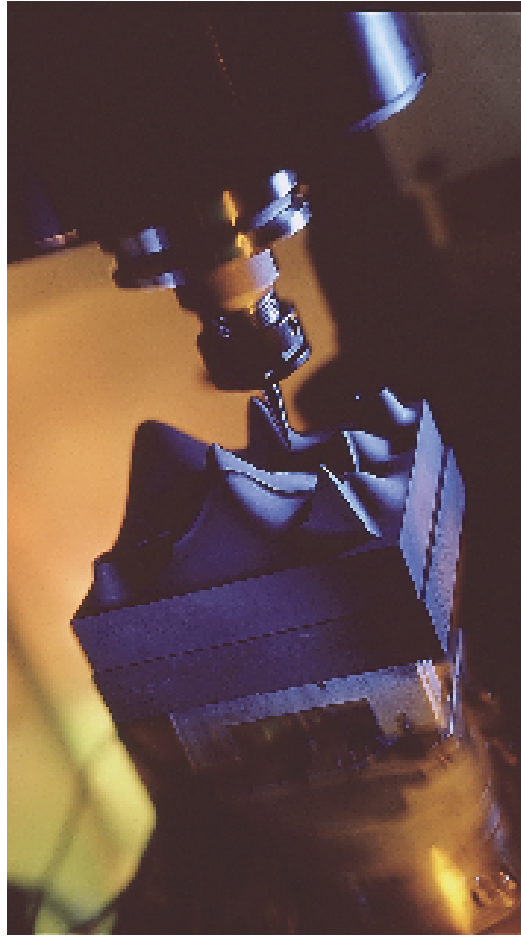
Millstar focuses on designing tools and developing applications for the die-and-mold and aerospace industries. Its customers cut complex, 3-D shapes on

3-, 4-, and 5-axis machines. Their success partly depends on their ability to properly apply different types of cutting tools in different ways.

Bradley said that cutting tools respond differently to the type of cutting mold-makers do most often. "We do some flat 2-D cuts, but most of our work is 3-D. You have to be concerned with straight cuts, but the tool also has to feed up and down, with the cutters plunging into the steel," he said.

Toolmakers tailor their products to meet these different ways of cutting. Field said that Millstar, for example, developed a toroid-style insert for the die-and-mold and aerospace industries. The insert allows for higher surface speeds versus other bullnose cutters, and, because of the insert's stronger edge, higher chip loads are possible. Especially germane to moldmaking is an insert's ability to cut metals with hardness up to 56 HRC.

Cutting tool industry professionals note that machine tool technology and cutting tool technology have leap-frogged one another, with one always seeming to be ahead. Jacobs said that 2 years ago, cutting tools were ahead of



Machining graphite electrodes is a big challenge for moldmakers.

the machine tools.

"Now the opposite has occurred, and the door is open for us to improve tooling," he said. "We have tools that can hold up to most high-speed machining applications and provide a lot of tool life compared to what we used to get. But graphite is the problem."

Field noted the biggest advancements to cutting tools that have allowed them to accommodate high-speed machining

A marriage of technologies

There's a growing camaraderie between machine tool builders and cutting tool makers. The reason is because each depends on the performance of the other's product to optimize their own product's performance.

"For the first time, I'm seeing cutting tool people actually working with machine tool manufacturers to develop new products," said Ron Field, vice president of applications for tool manufacturer Millstar LLC. "We each want our products to be shown performing at the optimal level."

One of the reasons machine tool builder Makino Inc. feels so strongly about working with cutting tool manufacturers is the big financial investment involved. High-speed machining technology carries a sizable price tag.

"I think there has to be dedication there on the part of the cutting tool people," said Walter Stuermer, Makino's technical sales specialist. "They have to have the same dedication to excellence as Makino, which raises the bar for both of us."

Stuermer pointed out that if there's a willingness on the part of cutting tool makers to spend time with Makino, then the company's customers will get the correct information about cutting parameters.

Stuermer also emphasized the importance of having an educated staff that's in touch with the market's needs. "They have to go out in the field and see what's working and what isn't," he said.

—C. Goldsberry

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have been enhanced carbide grades, better tool-grinding techniques and improvements in coatings, such as CVD-diamond and TiAlN.

According to Jacobs, Iscar currently is evaluating three different polycrystalline-diamond coatings. "We're waiting for the most stable one to come out on top," he said, adding that "there's been some research in materials such as diamond-like carbon, but it hasn't come to fruition."

Roughed Up

Besides machining graphite, roughing applications often test a moldmaker's skills. Walter Stuermer, technical sales specialist for machine tool builder Makino Inc., Mason, Ohio, described roughing as "the most challenging" application for cutting tools.

Stuermer said, "The biggest challenge that we present to our cutting tool manufacturers is getting a cutting tool that can hold up to a hardness of 50 HRC and above."

With respect to producing larger molds, the steel is typically roughed in the soft state then hardened for the finishing work, according to Stuermer. This sequence is important, because there is a significant downside to roughing in the hardened state versus a soft or prehardened state. "There are some applications where we can machine large parts after hardening," he said, "but hardness isn't the same in the middle as on the perimeter, and that results in a lack of integrity in the steel."

As a general rule, smaller molds are roughed in a hardened state. Arle Rawlings, president of Mastercraft Mold Inc., Phoenix, said the secret of machining hardened steel is to make sure that the cutter never leaves the workpiece. This prevents chipping and results in a smoother finish.

Another challenge is cutting 60-plus HRC material. "We feel very comfortable up to 58 HRC, but beyond that the ballgame changes," said Stuermer. "That's something we're working on

and this is where the dedication of the machine tool manufacturer comes into play. We're continually doing research and development with cutting tool people to develop the tools and the cutting parameters for those tools" (see sidebar, below).

Advancements are being made. For example, Sandvik Coromant Co., Fair Lawn, N.J., offers its Grade GC4020 insert, developed for high-speed milling in hardened steels up to 60 HRC. It also has a line of solid-carbide endmills for finishing and superfinishing materials up to 63 HRC.

Stuermer said he has seen a "dramatic increase" in tool life because of diamond coatings. "There's been an explosion in diamond coatings, as well as in TiAlN coatings," he said, adding, "but just because you have a TiAlN-coated cutting tool doesn't mean it's an effective cutting tool."

Like any tool, it must be applied properly. "We can go in with what works with a particular type of tool and, using the correct parameters, optimize the cutting tool life and surface finish, and maintain the integrity of the cut," said Stuermer. "The No. 1 thing we don't want to do is damage the cutting tool. Wear is OK—that's predictable—but damage is not."

Educating the Customer

Moldmakers eager to reduce the number of man-hours needed to produce a mold so they can effectively compete with offshore shops want to increase the amount of unattended machining they do. That means the moldmaker must have confidence in both the machine tool and the integrity of the cutting tool for long and/or overnight runs.

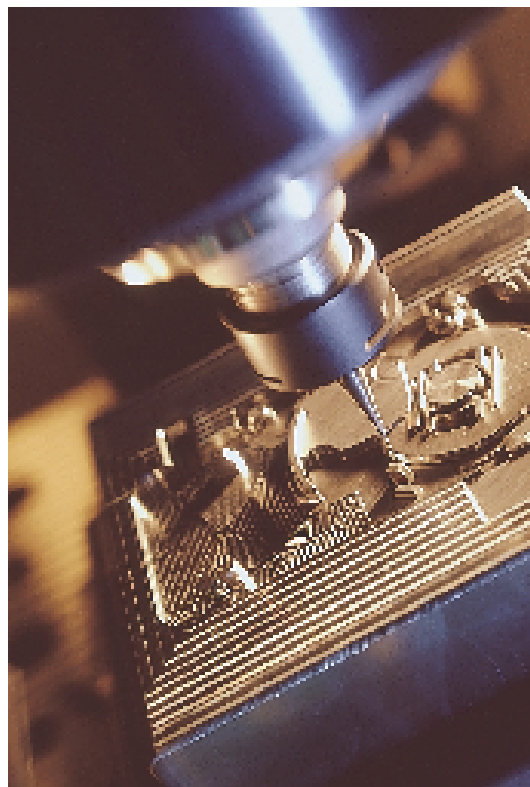
Toolmakers and machine

tool builders believe that education is the key to success in unattended machining.

Steve Piscopo, die and mold specialist for Sandvik Coromant, said that educating the company's sales force and its customers on the proper application of tools, how to program and select appropriate speeds and feeds, and what are appropriate applications for certain types of tools is critical to lights-out manufacturing.

"We realize the [cutting] tools are one part of the whole system," said Piscopo.

"Every case is different, but we see a fair number of people who want high-speed and lights-out machining, but don't take all the steps necessary to do that," Stuermer said. "I don't believe there's a bad machine tool—just wrong



The machine and cutting tool need to work harmoniously when operations are performed at high speeds. Here, a ratchet is being machined on a 30,000-rpm Makino V33 machining center. The rigidity of the machine allows the use of a 0.5mm endmill at a 10:1 length-to-diameter ratio.

applications for a machine tool.”

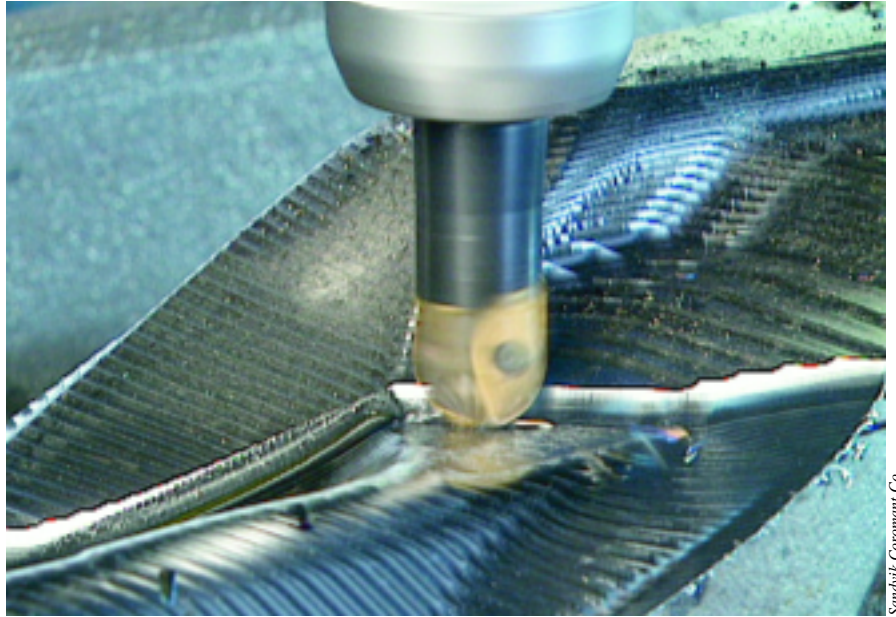
The Moldmaking Market

The amount of attention paid to moldmakers’ needs has risen the past few years.

“There used to be just a few [tool manufacturers serving the moldmaker market], now everyone wants to get into it,” said Stuermer. “One of the challenges we have is in trying to make sure everyone gets a fair chance to prove their products with our machine tools. Our research and development department is overwhelmed with requests for testing.”

Piscopo said that Sandvik is targeting moldmakers more now than in the past. Sandvik offers a complete package of informational materials for die and mold customers. It includes a brochure on its line of cutting tools, an application guide for die and moldmaking, and a book on high-speed and conventional die and mold machining.

And, the company is developing



Sandvik Coromant Co.

Roughing operations are another challenging area for those in the moldmaking industry.

products specifically for moldmakers, including indexable-insert tools. Historically, tool manufacturers didn’t aggressively market their indexable lines to moldmaking shops.

“Moldmakers work with these tools

quite a bit now,” noted Piscopo.

About the Author

Clare Goldsberry is a freelance writer for the plastics-injection-molding and moldmaking industries.