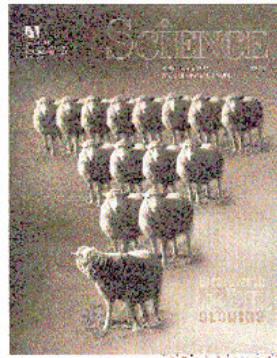
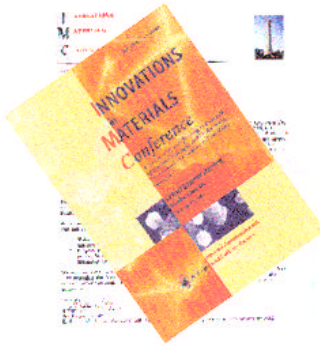


"The pièce de résistance of the QQC technology, Roy said in his talk, is a fuel-injector nozzle made of iron-silicon alloy that was transformed in three ways: The laser treatment deposited a TiC cladding, converted the top layer of the alloy to martensite, and transformed the alloy underneath (down to several tens of micrometers) into an amorphous metal - all without any signs of melting or changes in the object's dimensions. This is a "staggering" transformation, Roy pointed out..."



"The laser process, Roy reported at the Boston meeting, rearranges the atoms of the metal itself into new, high-strength configurations, and can blend added coating material into the underlying metal, atom by atom, to form an alloy that is less likely to degrade. Roy concludes that the technique "is a major discovery."

"Your work has been nominated as a significant innovation in the field of materials science, representing a new, step-function advance in the development of a real material rich with potential for application."



"Laser coating method transforms surfaces."

"A laser technique that converts the surface layer into a superhard coating not only on metals, but also on ceramics and plastics, has reportedly been developed by QQC, Inc., Dearborn, Mich. The process works by overlapping the light pulses from at least three types of high-powered lasers - ..."



"The shock of the high-power excimer laser combined with the temperature of the CO2 laser caused a cloud of white plasma. Engineers dropped the fine titanium carbide powder mixed with a carbon-rich gas into the white plasma cloud. Seconds after the plasma absorbed the titanium carbide surface - several times harder than the original surface. All this occurred without melting or causing visible changes to the nozzle."



"NEW PROCESSING TECHNOLOGIES EMERGE"

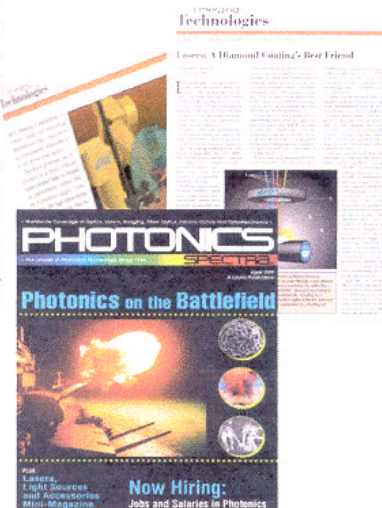
"In 1995, a new mass production diamond and diamond-like films using an interactive laser technique was developed by QQC, Inc. (Dearborn, MI) and was officially announced in early 1996. Since the advent of this new technology known as the QQC process, diamond and diamond-like films and coated products have reached to a greater level of activity in film applications. One advantage of this new technology is that it can deposit films at a very low temperature."

"LASERS: A DIAMOND COATING'S BEST FRIEND"

The process directs laser energy at a substrate to mobilize, vaporize and react with a primary element like carbon contained within the substrate. This modifies the composition of the carbon and diffuses it back into the substrate.

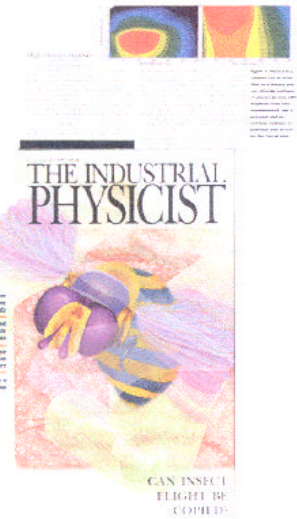
"As an adjunct to fabricating a coating, this creates a conversion zone immediately beneath the substrate, which transitions metallurgically from the composition of the underlying substrate to a composition of the coating being fabricated on the surface, or diffusion bonding."

Cover Article



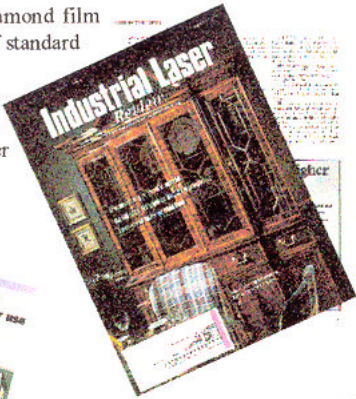
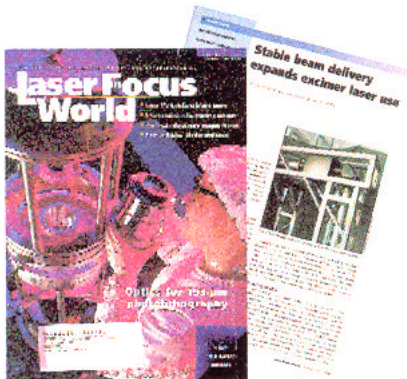
"PLASMA-AIDED MANUFACTURING FOR MICROELECTRONICS"

Plasma processes can generate films. However, these films often require much higher pressures and different techniques than are used in high-density plasma chambers. For example, researchers at QQC Laboratories (Dearborn, Michigan) and Pennsylvania State University (University Park) use a combination of excimer, Nd:YAG, and CO₂ lasers to ignite a plasma consisting of nitrogen and carbon dioxide at atmospheric pressure. This technique results in the deposition of high-quality diamond film. Such films can be laid on a metal substrate.



“QCC’s patented laser technique for diamond film production supplants the disadvantages of standard chemical vapor deposition...”

“The key advantages of QCC’s laser processing over CVD are easier processing, much higher process speeds, and higher flexibility.”



“Prof Roy also believes that the technology behind the QCC process ... is fundamentally sound, calling it the “biggest single step function discovery in diamond science and technology.” He adds: “As if from nowhere, QCC developed a process for depositing crystalline diamond and TBNC (tetrahedrally bonded non-crystalline carbon) on demand.” QCC can be applied on a variety of surfaces including tooling.”



“A novel application for this beam-delivery system was recently developed by QCC Inc. QCC has developed and patented a method of generating a diamond coating on both ferrous and nonferrous metals. This technology can have a potentially large economic impact on the machine-tool and automotive industries, among others.”

“Conventional techniques require placing the entire object either under very high heat and pressure or in a vacuum chamber for hours at a time while carbon crystallizes on its surface. Mistry’s method is much simpler.”

“If you look at current technology, it can do flat plates and a few simple shapes ... Give them a drill bit and they can’t coat it. We can coat pretty much anything.”



“QCC is not a CVD or PVD process and does not require an atmospheric chamber. The substrate does not have to be pre-cleaned, pre-treated nor pre-heated and does not require dangerous gases or long cycle times. The coating can be applied selectively and it achieves a true metallurgical bond with the substrate, circumventing spalling or flaking.”

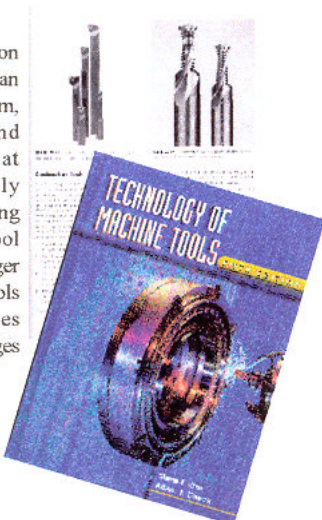
“Even at production rates of 600 parts per hour, Turchan claims its dry-metalcutting systems can generate surface finishes on aluminum parts that are as good or better than the finishes attainable using cutting fluid.”

“Turchan’s president, Manuel Turchan, says that machine rigidity is necessary for dry endmilling and drilling of aluminum with small-diameter tools at spindle speeds greater than 60,000 rpm.”

“In most cases, a dry-metalcutting system will repay its entire capital cost in a period of 18 months to 30 months.”



“This combination drill/thread tool can be used in aluminum, cast iron, and materials that produce easily broken chips. Using a combination tool frees up tool changer space for other tools and eliminates several tool changes per operation.”



“An Era of New Technologies”

“NASA is also interested in new developments from several high-tech small companies. Three of these companies are ... and QCC Turchan Technologies, Dearborn, Mich.”

“The new process at QCC Turchan Technologies is laser fusion bonding.”



“The Application Driven Technological Breakthrough”

“...the biggest single step function discovery in diamond science and technology in all history. As if from nowhere, QQC had come up with a process for depositing crystalline diamonds or TBNX (tetrahedrally bonded noncrystalline carbon) upon demand.”

“QQC not only had developed the process but they had made a dozen different products past the pilot stage; cutting tools, drill bits, ceramic hip joints, brake rotors, etc.”

“However, the QQC process, unlike I.PSSS, is already far into the technology stage of the R/D process. It is a working, engineered process which can produce a wide variety of new products in a very short time.”

“Enter QQC’s laser-assisted plasma process, which is done in open atmosphere.

Although it is a high-temperature process, the laser energy is closely focused at the point where the diamond is being created and bonded to the surface so that only a tiny volume of the substrate is heated. And it is so rapid, according to Mistry, that hardened and tempered HSS tools are coated with less than a 2-point drop in Rc hardness - well within the normally accepted hardness range for HSS cutting tools.”



“Lasers Make Fast Diamond Films”

“Dearborn, Mich. - A new laser technique that can make “acres of diamond film” several thousand times faster and easier than chemical vapor deposition techniques has prompted a flurry of interest from firms that want low-friction, rugged coatings for industrial, automotive, medical and optical applications.”

“Because it uses standard machining lasers ... the technique can be built into a system for many materials processing steps, Turchan said. This system can be thought of as the toolroom of the future, ...”



“The Thriller Tool is a fast, economical, and highly precise method for producing threaded blind holes that will change the way you think about threading from now on.”



“Part of the Thriller Tool’s productivity advantage stems from the elimination of three tool changes from the hole making operation ...”



“... if the new diamond-coating technique proves to be as cheap, fast and effective as its inventors say, it may revolutionize the manufacture of machine tools, automobile engines, ships, beverage cans and much more, material experts say.”



“QQC, Inc. offers a diamond coating technology that is described as a breakthrough in the search for a practical, economical method of depositing controlled thickness of diamond.”



“Depending on the purity of the product, diamond conducts heat from 3-6 times faster than copper, at rates as high as 2,500 W/m-K, while also exhibiting semiconductor properties. At the very least, inexpensive diamond substrates will be invaluable to the shrinking world of microelectronics, which is seeing growing problems with heat dissipation.”

“... Dr. Pravin Mistry unveiled a new technique for diamond deposition that may at last make the diamond coatings a commercial reality for tools and wear resistant parts.”



“Dr. Ajay Malshe of the University of Arkansas ... confirms that he has seen the process in action and has verified that the coatings are indeed diamond. Dr. Malshe ... adds that the industry can look forward to deposition rates of 1 micron per second on small surfaces, as compared to typical rates available with other processes of 1 micron per hour, 3,600 times slower.”



“While Mistry says his process works on virtually any substrate, that’s not the case for CVD diamond.”



"By unintentionally substituting the wrong gas for one they intended to use for hardening tools, workers at a small metallurgical company have accidentally hit upon a potentially valuable method for coating objects with a hard diamond film."

"To manufacturers ... a securely bonded diamond coating that is able to extend the life of a drill or die or saw or axle by thousands of times would be worth its weight in gold. Such a coating may at last be within reach."



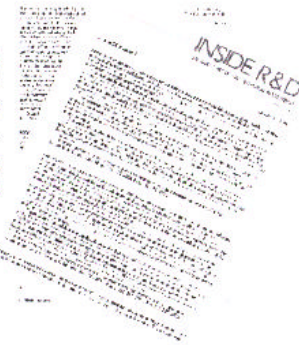
"A process that creates pure diamond and bonds it to a surface with the ease of paint on brush looks set to change the manufacture of objects ..."

"Fred Gray, the association's president, says the new rapid coating technology, which makes its use in manufacturing cheaper and more flexible, could expand the market for synthetic diamond significantly."

"The interest is due to the implications of making the hardest known material quickly and in almost any shape."

"Valenite, Cincinnati Milacron's cutting tool business, has tested QQC coated samples against others. "We found them to be the best in terms of performance, wear and adherence," says product manager Karl Katbi.

"Top diamond film researcher Rustum Roy at Penn State has arranged for the lab to study the mechanism and already calls it one of the biggest materials developments of the generation."



HEAT TREATING/COATING

QCC Inc. has developed a room temperature diamond film deposition technique in which three carbon dioxide lasers supply pulsed energy in an atmosphere of carbon dioxide and nitrogen has been developed at QQC Inc., Dearborn, Mich."

"A room temperature diamond film deposition technique in which three carbon dioxide lasers supply pulsed energy in an atmosphere of carbon dioxide and nitrogen has been developed at QQC Inc., Dearborn, Mich."

Metallurgists run across new way to diamond-coat, setting industry abuzz

Metallurgists have discovered a revolutionary method for coating objects with a hard diamond film. The process, developed by QQC Inc. of Dearborn, Mich., uses three carbon dioxide lasers to create a diamond film on a surface at room temperature. This method is a significant breakthrough in the field of diamond coating technology, as it allows for the production of high-quality diamond-coated tools and components without the need for high temperatures or complex equipment. The discovery has the potential to revolutionize various industries, including manufacturing, automotive, and aerospace, by providing a more efficient and cost-effective way to produce diamond-coated parts.

"This is an interesting instance of technology leading science," said Dr. Rustum Roy, who heads the Diamond and Related Materials Center at Pennsylvania State University. The discovery was made by accident when workers at a small metallurgical company substituted the wrong gas for one they intended to use for hardening tools. This led to the development of a new diamond coating process that is now being studied by researchers at Penn State.

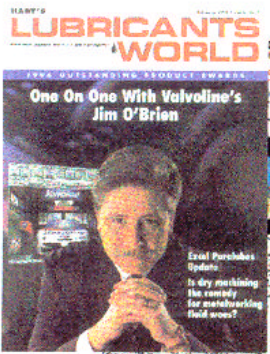
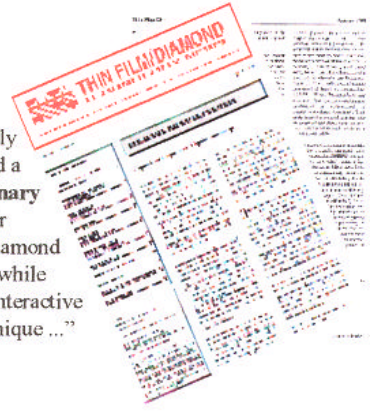
... workers at a small metallurgical company have accidentally hit upon a potentially valuable method for coating objects with a hard diamond film. ... it has spurred excitement among potential users, including the armed forces and the automotive and packaging industries.

The discovery of a room temperature diamond coating process has set the industry abuzz. Metallurgists at a small company in Dearborn, Michigan, discovered the process while working on a different project. The process involves using three carbon dioxide lasers to create a diamond film on a surface at room temperature. This is a significant breakthrough because it allows for the production of diamond-coated parts without the need for high temperatures and complex equipment. The process is simple and cost-effective, making it a promising technology for a wide range of applications. The discovery has attracted the attention of researchers and industry professionals alike, and it is expected to have a major impact on the manufacturing industry in the years to come.

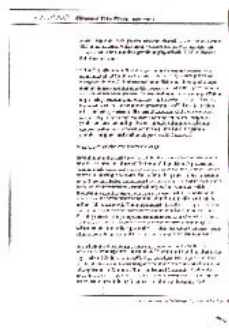
"This is an interesting instance of technology leading science," said Dr. Rustum Roy, who heads the Diamond and Related Materials Center at Pennsylvania State University.



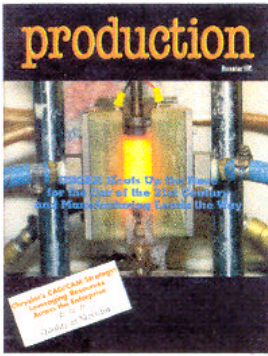
"QQC accidentally discovered a revolutionary process for making diamond materials while using its interactive laser technique ..."



"One of the most successful dry machining systems specialists is the Turchan Technology Group in Dearborn, Mich." ... using tools with QQC diamond coatings for dry machining of aluminum, an operation can produce 600 parts an hour instead of the 35 achievable by conventional machining centers."



"Technical details of QQC's method are still scarce, but what has so far been publicized is intriguing: DTF coating is achieved at room temperature and without the need for a vacuum environment, thus overcoming two of the most problematic aspects of existing CVD and ion beam methods."



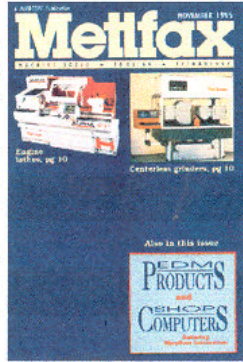
“So it just may mean that higher-performance machining can actually provide benefits of an environmental nature.”

- There is no coolant involved. This eliminates a disposal problem.
- Any health problems related to coolants are eliminated.
- Chips are clean and dry. They can be recycled more easily.
- Since there is no coolant, floors around the machines are dry. This contributes to a safer workplace.”

“A new three-in-one tool offers cost and time savings, plus better quality, in producing threaded holes from the solid in machining centers.

In a single operation, the patented Thriller tool performs what would otherwise require individual operations by a drill, chamfering tool, and tap, with two additional tool-change cycles.

Reported benefits include dramatically reduced cycle times, improved thread quality compared to conventional tapping operations, and tool life exceeding 10,000 holes per tool.”



“CNC changes the rules: Thread milling is not just for Class 3 threads anymore”

“... the automotive industry is showing more interest in combination tools now that it is using CNC much more extensively on its production lines. Interest also spread to the boat-building industry when Turchan customized the tool [Thriller] to seat spark plugs for Mercury Marine (Fond du Lac, WI), an outboard motor manufacturer.”

“Besides saving a minute and five seconds on this threading operation, the tool will be part of Mercury Marine’s strategy to comply with EPA demands to reduce outboard motor emissions.”



Cover Article

“A breakthrough in diamond coating technology could take us a little closer to the day when dry machining is the rule rather than the exception . . .”

“The introduction by QQC, Inc. a member of the Turchan Technologies Group, Dearborn, MI, of a new diamond coating technology marks the commercial introduction of a process that has already proven itself in high-speed dry machining of automotive powertrain components at GM’s Power Train Div, Bay City, MI.”

“The QQC coatings can be applied to tools including cutting tool inserts, round tools such as drills and reamers, curved and irregular surfaces, and large flat areas in thicknesses up to 1mm and to any grade of tungsten carbide, ceramics, cast iron, stainless steels, and a variety of other ferrous and nonferrous metals and non-metallics.”

Cover Article



“Two twin-spindle mills replace nine belt sanders to face-mill aluminum transmission channel plates flat to 0.002-in.”

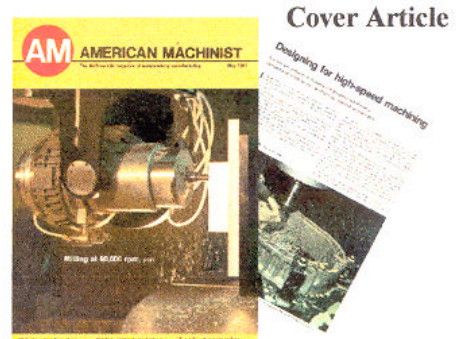
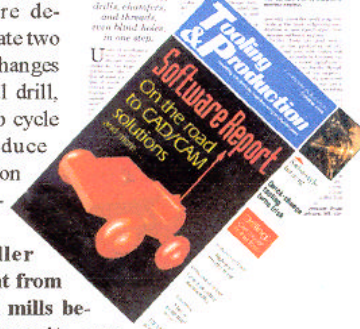
“Over 2 million channel plates were run across the two twin-spindle mills in a two year period and approximately \$3 million/yr is saved over the previous process.”

“The Thriller Tool drills, chamfers and threads, even blind holes, in one step.”

“The tools are designed to eliminate two complete tool changes from the normal drill, chamfer, and tap cycle used to produce threaded holes on machining centers.”

“The Thriller Tool is different from existing thread mills because it produces its own chamfered holes and produces threaded blind holes.”

Tool is a driller/thread miller



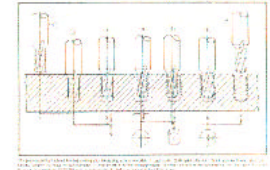
Cover Article

“That machine, designed specially for display at the International Machine Tool Show in Chicago . . . attracted a fair amount of attention for its builder, Turchan Inc (Dearborn, Mich), because of its use of a 20-hp, 60,000-rpm magnetically levitated spindle, the first time such a spindle had ever been displayed milling metal.”

AMERICAN MACHINIST

New turns in thread cutting

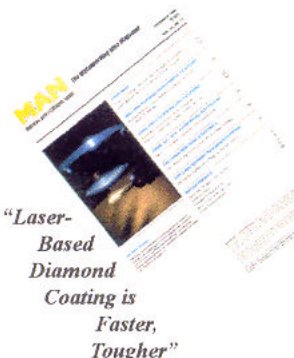
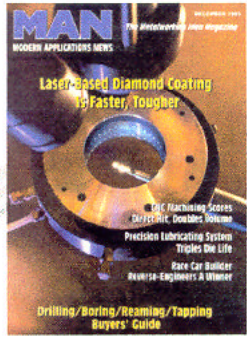
Thread cutting is being done on a lathe with a magnetically levitated spindle.



“Thrilling is the latest, hottest innovation . . .”

“THRILLING, a hot new process in the field of thread cutting, promises to revolutionize threaded-hole production by combining short-hole drilling with thread milling in a single high-speed process . . .”

Cover Article



“Laser-Based Diamond Coating is Faster, Tougher”

“A new diamond coating technology is providing an economical method for depositing controlled thickness of diamond on cutting tool inserts, round tools such as drills and reamers, curved and irregular surfaces, and large flat areas. The process, from QQC Inc., . . . uses lasers and proprietary technology to produce the surface coatings, which have been successfully used on production metal-cutting tools and milling inserts.”



“For nonferrous metals and non-metal abrasive composites, diamond coating has unmatched hardness, chemical resistivity and lubricity.”

“A recent diamond coating technology from QQC Division of Turchan Technologies Group, in Dearborn, MI, promises a practical, economical method for depositing a controlled thickness of diamond on cutting tool inserts of any shape and geometry. The patent-pending process uses lasers and proprietary technology to produce surface coatings on cylindrical tools, such as drills and reamers.”

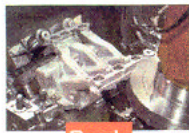
“Unlike CVD diamond coating, the QQC coating process uses laser-based techniques to clean, coat and (if necessary) polish a workpiece or cutting tool in a single, high-speed process. The result is usually approximately 1000 times faster than CVD coating.”
 “. . . the QQC process creates a very strong, true metallurgical bond between the diamond coating and the substrate. . .” “A further advantage of the QQC process is that it uses no wet chemistry. . .”



“Currently, eight high-speed (15,000 rpm) dry diamond [Turchan] machining systems have been installed or purchased by the Big Three.”

“As the regulations tighten, GM is chasing a moving target. ‘The only way to eliminate the problem is to eliminate coolants,’ . . . according to Dennis Harvey, Manager, Manufacturing Integration and Machining Systems, GM.”

Diamond Coatings:



Ready to Rip?

“Turchan . . . (Dearborn, MI) has been interested in diamond coatings as an enabler for the high-speed dry machining it does for the auto industry. . .”

“Turchan’s Pravin Mistry had been working on advanced materials for aluminum extrusion when he discovered a method of producing diamond coatings using a novel laser-based plasma process conducted in open atmosphere.”

“The work drew the attention of scientists at the Materials Research Laboratory at Pennsylvania State University, a leading center for research on diamond film technology.”

“It is absolutely one of the biggest developments in materials synthesis in a generation,” says [Rustum] Roy. ‘And the amazing thing is that it was done entirely as part of a production, not a research, process.’

“. . . an official at the Office of Naval Research, who visited QQC, tells C&EN that the office intends to support research on the process. Test results that he saw confirmed that the coatings were diamond films.”



“One-Step Tool”
“Drills, chamfers, and threads”

“Thriller tools are designed to produce threaded holes from the solid, eliminating the need for separate drilling, chamfering, and threading.”

“The tools are applicable with aluminum, cast iron, and various other materials that produce easily broken chips.”



One-step tool

Drills, chamfers, and threads. Thriller tools are designed to produce threaded holes from the solid, eliminating the need for separate drilling, chamfering, and threading. The design of the tool produces the hole, then the threaded hole, and finally the chamfer. When the thread is formed, the tool is retracted to the hole, and the tool can produce both blind and through holes. Thriller Inc., Dearborn, MI. (313) 733-2723



“... tools that exploit the CNC’s capabilities for helical interpolation to perform in a single operation what would otherwise require individual operations.”

“A good example of such unusual and interesting tools is the Thriller Tool . . .”
 “Properly applied, the result is a significant cost and time savings, together with improved quality . . .”

“The Thriller Tool was developed by Turchan president Manuel Turchan primarily as an enabler for complete high speed machining of nonferrous parts. This tool represents a step toward gaining the same kind of benefits achieved in high speed milling in other high speed operations . . .” “These operations have been hindered in the past by the limited availability of spindles with sufficient rpm to run them at milling surface speeds. . .”

“The Thriller Tool relieves these problems, because it never has to stop or reverse.”



Cover Article



THE COVER
Diamond coating



“Diamond Coating”
“For round tools”

“A proprietary coating process can deposit controlled thicknesses of diamond on round tools, curved and irregular surfaces, and cutting inserts.”

A US patent is pending on the process, which uses lasers and proprietary technology to produce diamond coatings up to 1 mm thick on carbide, ceramic, cast iron, steel, and other substrates. The ability to selectively coat round and irregular surfaces is unique among diamond coating processes. . .”