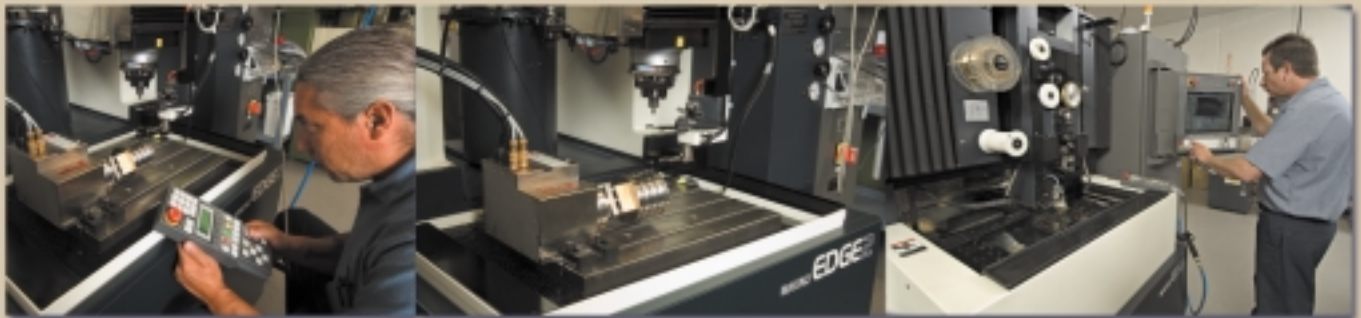


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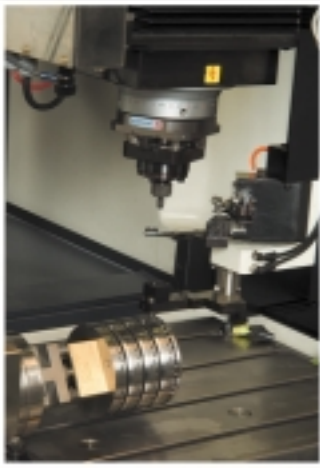
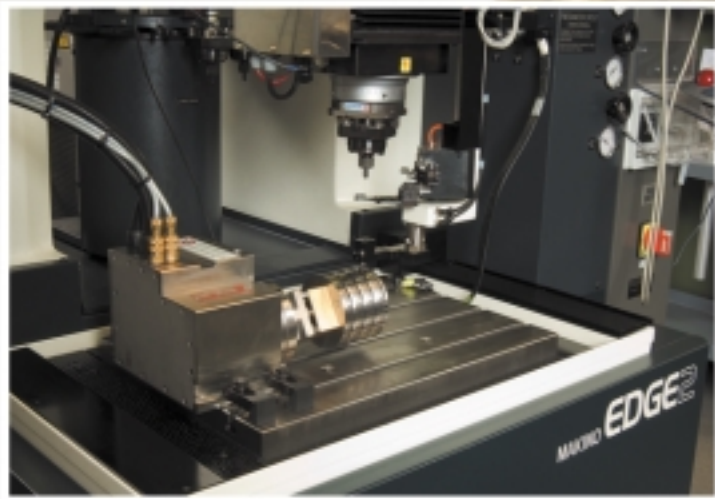


Micro-Medical EDMed Parts



Johnson Matthey Goes PLATINUM

Company Uses Valuable Metal for Micro-Medical, EDMed Parts



In the music industry, “going platinum” means selling a million record units. In the medical world, it means utilizing the versatile metal for anti-cancer drug advancements, as well as the production of biomedical component parts.

Platinum is ideal for these micro-medical parts, as the material is inert and will not corrode inside the human body. Allergic reaction by humans is rare, and the metal provides good conductivity for electrical components, and it is highly malleable.

But the value correlation of “going platinum” is the same in both the music and the medical industry, due to the high value of the metal. A solid, 16-ounce sized beverage can of platinum would weigh about 50 pounds, and would be worth well over one million dollars.

As the world’s leading manufacturer of platinum, Johnson Matthey utilizes its vast metal resources for micro-medical parts production at its ultra-secure, 120-employee facility in San Diego, California. And, they count on Makino EDM “small hole” technology to make the most challenging and complex parts possible.

Johnson Matthey EDM department lead Scott Breneman says, “Determining how to accurately and efficiently fixture the micro-medical parts is often our greatest challenge. Once we’ve done that, Makino’s small hole EDM technology does the rest.”

“This technology produces high quality, detailed secondary operations in the mass produced parts, due to the extremely accurate capabilities of Makino. I just don’t know how we could serve our customer’s needs any better.”



Global Commodity

Johnson Matthey is the largest trader of platinum in the world. They buy, sell, and move product around the globe, dealing in freshly mined material as well as re-circulated product that has been recaptured or salvaged from manufacturing use.

The company also operates refining and machining operations in plants around the United States and the globe. These facilities produce tubing, rod and bar stock, and platinum alloy wires.

Jyrki Larjanko, engineering manager for the medical products group in San Diego, says the Johnson Matthey name not only signifies the marketing of platinum, but also the value-added manufacturing of it and other precious and specialty metals. "There are many people out there that now only think of us as a quality medical components operation," says Larjanko.

"As part of the precious metal products division, our group's mission is 'To provide the medical industry with precision micro components manufactured from platinum and other specialized materials,' with a vision toward 'Providing the best of products for the best of life'."

The ISO 9001/2000 certified operation handles a diverse assemblage of raw materials for medical parts production besides platinum, including iridium/platinum alloys, platinum 10 percent nickel, platinum 8 percent tungsten, gold,

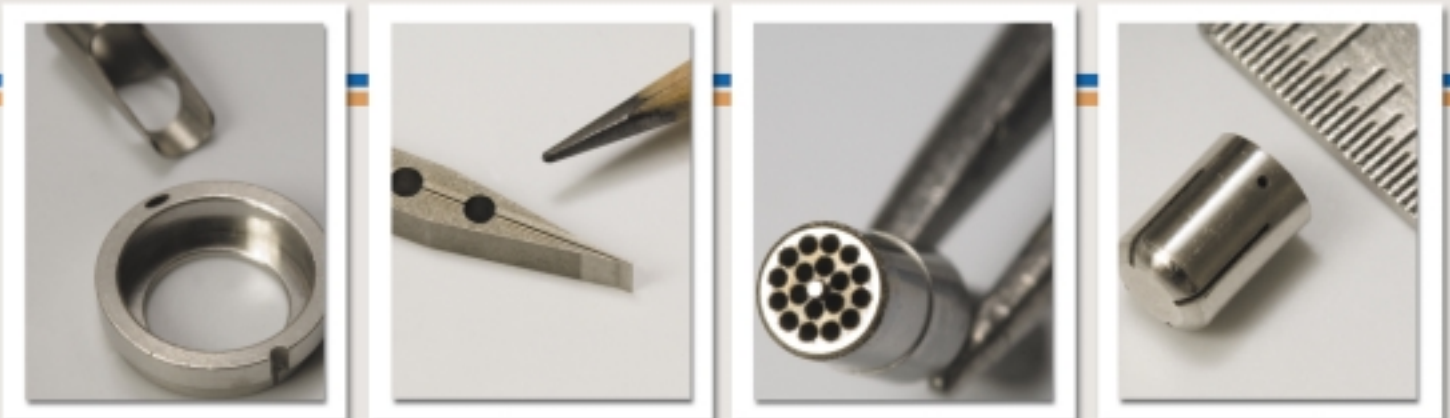
rhodium, and nickel titanium (nitinol). They also machine base metals such as medical grade stainless steel, titanium, kovar, elgiloy, tantalum, MP35N, L605 and plastics, as well as many others upon customer request.

First to Market Innovation

"Our customers are innovators," says Larjanko. "They are always seeking smaller and smaller parts, and the enhanced utilization of novel and exotic materials. And our service and response are often pre-product and rapid prototype initiated, requiring dedicated design and technical capabilities."

"The diversity of these products includes micro and small machined parts, wire and ribbon, clad wire, tubing and cut tubing, hypotubes, powder and sputter coating, and sheet and foil parts. But, their customers also demand constantly improving surface finishes, tight dimensional tolerances, improved manufacturability, shorter lead times, on-time performance, alloy development and substitution, and inventory and supply chain control, including on-line order management."

"Every single day that our customers are not in the market with new devices, it costs them millions of dollars in sales," says Larjanko. "And we have found that our ability to work with them to produce a quality prototype is imperative to success."



“It takes a long time to get a medical device to market. There are trials and tests, as well as extensive documentation procedures and analysis. And, once a company gets behind on a product concept, it is almost impossible to catch up.”

“The versatility of Makino EDM machines allows us to be able to deliver precision R&D prototypes in just a few days,” says Larjanko.

“When you can send a quote to a customer, and in less than ten days deliver them a workable, detailed ‘rapid prototype’, that gives us a big advantage in our service. And that helps our customers reach this competitive, fast-paced and innovative marketplace in record time.”

Micro Medical Production

The Johnson Matthey medical products group San Diego facility has a full array of machines at their disposal that mill and burn platinum, as well as other exotic metals. These include a diverse mix of swiss screw machines that do the mass part production of the medical components, a half dozen Makino machines dedicated to various

micro operations. Other value-added and secondary operation capabilities include sputter coating technology, laser welding and cutting, as well as fine diameter tube cutting.

To accommodate production capability and performance detail, we have a very strict sampling process for medical approval,” says Larjanko. “And, Makino machines allow us to get the detailed micro-medical parts right the first time.”

“These machines have a lot of features for the secondary details on medical micro components that mass production screw machines simply cannot provide, meeting customer specifications, such as burr free production. The versatility and high degree of accuracy provided by a Makino EDM machine is amazing, and as a secondary operation, it actually makes the part a reality, not just a concept.”

“We also use the Makino EDM technology for some primary operations,” says Larjanko. “With the Makino machines, we have actually been able to cut precious metal tubing on the machines, that we previously couldn’t do in any other fashion.”

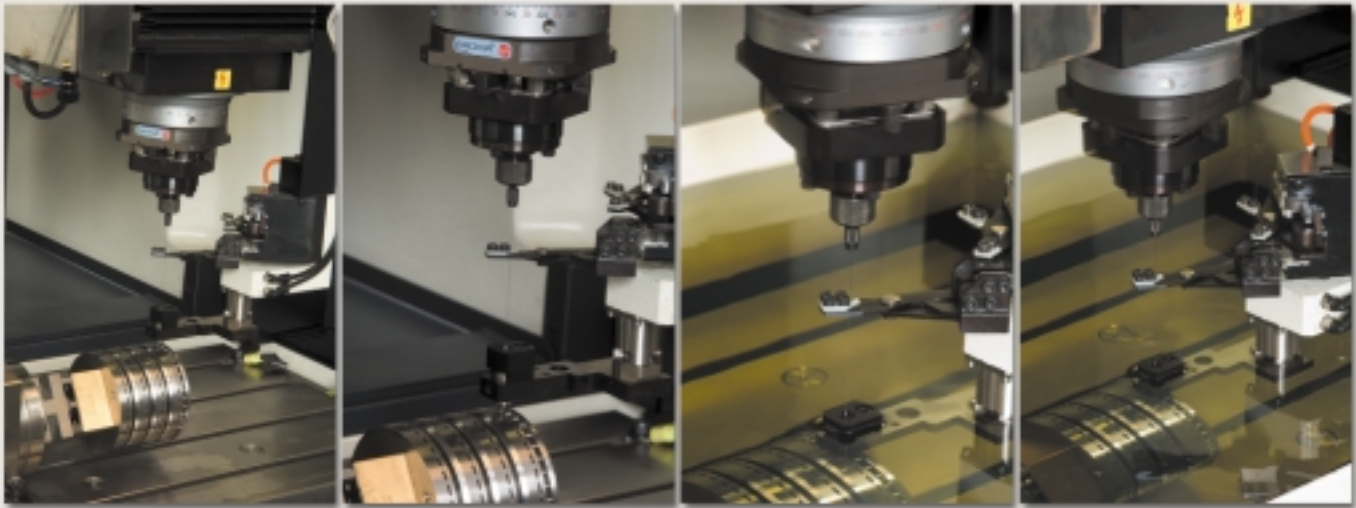
“Another example is in fine core hole popping. These holes need to be incredibly accurate, with dimensions of 0.002 inches and tolerances of plus/minus 0.0003 inches. These Makino machines are the only one’s which can repeatedly do that kind of accurate hole making.”

Exceptional Details and Fine Holes

Johnson Matthey medical products has a full assemblage of Makino machinery to support its needs for capability and capacity. They’ve purchased two Edge2 Ram EDM machines, one with the fine hole option, as well as a U32J and a U32i wire EDM machine for a majority of the micro detail work. These machines are supported by a pre-existing Makino RMC 55 milling machine and an Edge1 Ram EDM machine.

“This allows us to machine and mass produce medical device micro components for a wide range of customer end use applications,” says Larjanko. “The U32i has produced a high quality, low cost solution and marketplace for us.”





“The Edge 2 fine hole machine has not only improved cycle times, but also provided better yield rates with higher accuracy. They simply hold and maintain exceptionally small tolerances, and have become our workhorses.”

“Makino is able to run parallel with the demands from the medical device industry,” says Larjanko. “They have been able to deliver equipment that can meet those demands on the market, keeping up with both the device manufacturers and the device suppliers.”

“The Edge 2 with the fine hole option is used for a lot of our development jobs, due to its accuracy and detail. We can burn in the tens of thousandths (0.0001 inches).”

“And, the purchase of this technology is cost efficient,” says Larjanko. “A dedicated, fine hole drilling machine by itself would cost twice as much as the fine hole option on the Edge 2, without the ability to do standard sinker machining.”

“We are able to utilize the fine hole machine to exceed the precision micro component demands of the medical device industry. We can maintain dimensional tolerances from 0.005 to 0.0002 inches, concentricity to 0.001 inches, edge breaks and corner radius/fillet at from 0.002 to 0.005 inches, and burr tolerances below 0.0005 inches.”

“Magnificent surface finishes can be produced down to 5 microns,” says Larjanko. “Along the way, we have eliminated, or at least minimized, random tool marks, dings and dents utilizing Makino technology and solutions. No foreign material is visible at a 10x magnification on any Makino EDMed micro-medical part details.”

Auto Index Option

The technology that Makino provides Johnson Matthey on the Edge 2 with fine hole capabilities includes the addition of an auto indexer. This option has significantly helped them accomplish their EDM tasks.

“We initially contacted several suppliers prior to acquiring an auto indexing unit, with little success finding someone who could talk our micro-medical language,” says Larjanko. “This auto indexer was necessary, in order to allow us to do multi-axis machining that we were unable to do previously. Plus, it was needed to further enhance our process repeatability and our ability to run unattended for many hours.”

“We then decided to lean on Makino to help us, and they not only advised us which one would be our best choice for performance, but also as to which one was most compatible with the Makino machines to accomplish our desires. The Hirschmann unit we acquired got up to speed right away, as Makino personnel had it in place and burning within a few hours of its arrival at Johnson Matthey.”

“We can actually use the indexer in conjunction with Makino wire or Ram machines, to take any part and put a hole or a slot in it, anywhere on the part, no matter how small the part, and no matter how small the hole or slot,” says Larjanko.

“As much as we like our screw machines, they just can’t do everything,” says Larjanko. “The Makino EDM machines and the auto indexer have become the star of our department and our plant. The detailed fine hole capability saves us significant time and money on parts, some of which are made of rhodium, and even more expensive metal than platinum.”

Reducing Scrap

Because the metals used in medical-micro technology are so expensive, inventory levels need to be kept at a minimum during production. Scrap must also be reduced accordingly; even when scrap metal recovery is at such a high level as it is with Johnson Matthey. The refining of precious metal remains very labor and cost intensive.

“With micro-medical advancements that require smaller and smaller parts, we must save time and money in production for our customers,” says Larjanko. “Often this requires a process improvement from what they have been used to doing.”

“On one part, we struggled with getting a fine hole properly done on the screw machines. We could barely get a 50 percent yield of good parts, which is entirely too much scrap. Most of that scrap was because the different angles of the detailed cross-holes were just not up to spec.”

“Johnson Matthey worked with the customer to propose changing the process for these particular features on the Makino EDM machines,” says Larjanko. “Virtually all of the parts came out compliant.”

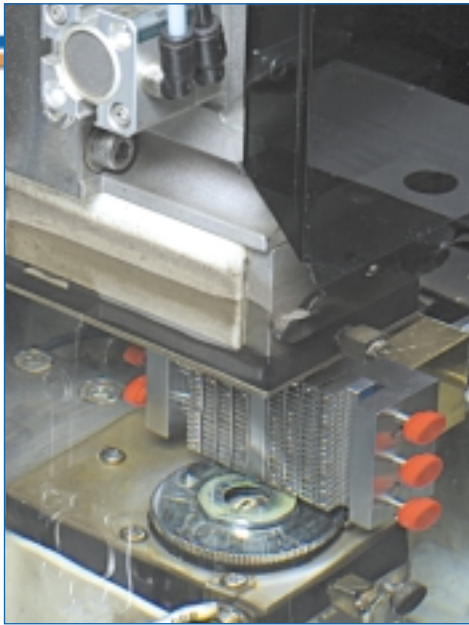
“This eliminates a scrap problem and saves us a customer. We are confident more work will move toward Makino technology, as we have already begun to migrate some screw machine parts to EDM operations.”

R&D Development

Johnson Matthey is often proactively solicited by its customers on new research and development (R&D) processes and techniques. “More technically challenging materials that cannot be conventionally machined are constantly being presented to Johnson Matthey,” says Joe Kain, product manager for medical products.

“We are actually involved in several programs at our corporate office, where the materials being mass developed are not manufacturable in classic modes. And we have invested in multiple EDM capabilities to handle these technical materials, some of which are three to five years away from development. We are working with medical device companies to develop programs for the fabrication of these materials, and the versatility of Makino’s machinery makes them a great machining partner to have.”

“We work closely with our customers to develop processes and product designs to allow the machining



expertise of Johnson Matthey and the abilities of the Makino machines to solve their problems,” says Kain. “We can usually start working on any project right away.”

“We inform them of their options in operations and processes, and in micro-medical, we often find that we cannot make a particular feature or design without the Makino EDM machines. The bulk of the products we produce involve us actually developing the process and the part. We are not being asked to make a pre-existing part faster or cheaper.”

“By being contacted at the very beginning to make something totally new, we remain involved throughout,” says Kain. “We excel at starting with a part and watch it grow through development, prototype, product release, and full market release.”

“Some of the repeat customers seek us out before they even attempt to make a prototype. Can we do this? Can we do that? Is it even possible? These are questions we often are asked. With the Makino technology supporting our skills, the answer is usually positive.”

The Next Phase

New materials are always on the horizon in the rapidly changing, and ever shrinking, micro-medical components arena. “Medical grade stainless steel is gaining in popularity, as is the use of medical titanium,” says

Larjanko. “And advancements in EDM technology make it one of the processes we feel very confident can handle these material changes.”

“Whatever the future throws at us, we are going to be able to handle it with the Makino EDM technology. As parts get smaller, tolerances are getting even tighter, and we try to bring the highest level of sophistication to deliver the best possible products.”

“An advantage of the Makino machines is the huge range of parameters we can utilize to fine tune any part development,” says Larjanko. “And we not only want to make the part, but make it competitively. Makino machines consume less wire and graphite than other EDM machines due to the quality of the burn achieved.”

“With the Edge 2 machine, we started burning a micro-medical tube with small electrodes for fine hole drilling, where we actually run coolant through the inside of the electrode. This type of high technology application is huge for us, not only for accuracy and burr elimination, but also in its efficiency in tooling durability.”

“The more you can keep an electrode operating accurately without replacement, the less money you spend, and also the less time you are going to spend making replacements and in setup,” add Larjanko. “These are areas that constantly drive up costs.”

And with the cost of these precision metals, maintaining production costs at a level below “platinum” is essential for everyone!

Johnson Matthey has had significant success utilizing the Makino wire and Ram EDM technology on a number of micro-medical parts. Accuracies and details are quite high, and some run rates increased from 30 to 50 parts per hour.

On the following page, are some of those examples.

Johnson Matthey often manufactures medical microcomponents which get crimped around devices such as catheters, that makes them visible under radiosopes doctors use during less invasive interventions.

They also manufacture a graphite electrode with very fine, very accurate details in order to burn EDM slots in a platinum component part used for the slow release of fluids for drug anesthetist assistance. These slots are below 0.005 inches in size, and cannot be made any other way than with the Makino EDM technology and fine hole operations.

Johnson Matthey uses the Makino U32i wire EDM machine with 0.003 inch diameter wire to burn intricate geometries in extremely small products. By utilizing the EDM process, it is highly accurate and will be burr free. And burrs are a huge problem in medical micro machining, driving up costs due to the time and effort needed to eliminate the very small burrs through detailed benchmark.

Makino technology cannot only assist Johnson Matthey in making detailed holes, but also the EDM machines can repeat it all day long, even unattended work through the night.

They can actually fine hole a part to 0.005 inches using the Makino Edge 2 and the auto indexer. This actually becomes an automation process, as they can run the part non-stop for 43 straight hours without any problems.

Johnson Matthey also utilizes very small pipe electrodes in the Ram EDM burning of a catheter irrigation tip in 90 percent platinum, 10 percent iridium parts. The company first attempted to drill the operation on a screw machine, but they could only achieve 5 to 10 parts off of one expensive 0.005 drill bit.

Constant changing of the tool, limited part production and burrs, wasted significant time and money in the secondary part operation. Using the Makino Edge 2 machine allowed for a 12 position tool changer to just make the parts non-stop.

One micro-medical part was done entirely on the Makino wire EDM machine, which holds 0.0002 inches of symmetry on the tip, with holes running down the length of the piece. The part is used as a form tool for another component that is laser welded. It has a 0.01 x 0.006 inch wide, full radius rib on the top that must maintain the same 0.0002 symmetry. Due to the hardness of the material, and the detail required, it cannot be conventionally machined and has to be EDMed.

Another detailed part used a 12-inch long tungsten rod 0.0051 inches in diameter for the burning of a small micro-medical part.

Johnson Matthey manufactures small, 302 stainless steel ball bearings, which require 0.03 inch fine retaining holes burned through them on the Makino Edge2 fine hole machine.

The company manufactures a small medical dicing part that has eight features located radially around the outside diameter of the part, breaking into the inside. These are 0.008 inch x 0.015 inch rectangular ports, which radius outward to the OD, maintaining a maximum 0.002 inch maximum corner radius.

Johnson Matthey also has to manufacture a graphite electrode to burn these features, which have to be burned about four times each to achieve the maximum 0.002 inch corner radius requirement for the customer. This takes us about 40 minutes on the Edge 2.

Johnson Matthey manufactures a micro-medical part with three holes in the top and ribs around the edge in a two-step, two-process operation. This is run unattended over the weekend on the Edge 2 fine hole machine, using a graphite electrode to go around the outside and put in a small half moon radius in up to six places. Then three irrigation holes of 0.012-inch diameter are burned into the top.

It took Johnson Matthey a couple of weeks to develop a program to make the intricate electrode accurate enough to burn an elliptical pocket large diameter ring part. The ellipse is 0.011 inch by 0.030 inch, and proved to be quite a challenge. Once the electrode and program were completed, the Edge 2 popped out all of the details in short order.

A base metal part that needed to be welded to another base metal part required 18 holes to be radially burned around the top, through a 0.040 inch thick wafer. This intricate burning process only took a couple of minutes per hole (for 18 holes) on the Edge 2 fine hole machine.

EDM

