Techtips is a collection of useful ideas, techniques, and procedures designed to further EDM knowledge.

TechTips

by Roger Kern

IMTS 2008 Highlights

a "Toolmaker's" View

Summary & Highlights

I was privileged to spend two days visiting the EDM Pavilion at IMTS 2008. During those two days, I visited seventeen EDM exhibitors, examining the machines and technology on display and interviewing both marketing and technical staff members. I will attempt to present a "Toolmaker's" view of that experience. These highlights will be presented in two parts: A brief summary of the highlights of the show, followed by the highlights of the various individual exhibitors that I visited. Before I begin, I'd like to express my gratitude to all of the exhibitors I visited for the cordial reception I received, and their willingness to provide the technical information I requested. Finally, please note that it would be impossible for me to relate all that I saw at the show in this limited space. However, I will attempt to limit my reporting to those technologies and innovations that I believe our readers would find most interesting.

Show Highlights

The EDM technology displayed at IMTS was more evolutionary than revolutionary. However, that evolution in the technology has been very significant, providing numerous benefits and opportunities for improved quality and increased productivity.

If I had to identify the most notable themes of the EDM pavilion at IMTS, they would be:

- Aerospace
- Medical
- Micro EDM
- NASCAR

Since both the aerospace and medical sectors are excellent prospects for EDM applications and continue to maintain impressive order backlogs, these industries have become the focus of many EDM shops, and therefore many EDM builders.

The world of Micro EDM and Nano tolerances received significant attention from a number of builders.

Also, many EDM OEM's were promoting their associations with NASCAR teams, either by displaying cars or having NASCAR drivers at their booths.

Summary by EDM Sector

❒ Wire EDM

The reliability of automatic threading has received significant attention from most builders. The addition of annealing and stretching the wire makes threading less dependant upon the straightness of the wire. Reliable threading over extended heights, submerged or dry, and at the site of a wire break is now common.

The addition of an A-axis has now become commonplace. The A-axis is used in three ways:

- Indexing to burn more than one side of a part in a single setup.
- Spinning the workpiece so that the Wire EDM can be used like a lathe.
- Turn-and-burn where the A-axis is servo controlled and allows simultaneous 5-axis contouring with the wire utilizing X, Y, U, V, A axes.

The introduction of very large Wire EDMs, especially those with deep tanks and large Z axis travels.

Low cost machines specifically designed for medical production.

❒ Sinker EDM

The substantial intrusion of High Speed Machining into what was once the exclusive domain of Sinker EDM in forge die and mold cavity work, continues unabated. As the high speed machining process continues to mature, more formerly Sinker EDM jobs will migrate to it.

There has been a significant advance in the practical technology for EDMing very small holes and shapes. It is now practical to EDM holes down to .0004" diameter and slots as narrow as .0004" wide, with a tolerance of less than 50 millionths, as well as accomplish 3-D EDM milling to similar sizes and tolerances.

❒ Small Hole EDM

Small Hole EDM was originally developed for cooling holes in aerospace turbine blades many years ago. When the recast layer of those early generation machines proved unacceptable, the process was adapted to produce start holes for Wire EDM. Once the recast issues were addressed (and the initial success of Laser abated as airflow requirements became more demanding) the process has now come full circle and is dominated by aerospace turbine applications and innovations:

- Break-through sensing
- Video inspection and closed loop corrective process feedback
- Burning diffuser contours as well as just cooling holes

Exhibitor Highlights

(Presented in alphabetical order)

❒ Accutex

Accutex presented a full line of Wire EDMs. The speed and reliability of their wire threader was featured. The wire is annealed for the full length of the Z travel, and the wire threading process is servo controlled, allowing reliable threading at the break point in the slot, through interrupted cuts, and in dry or submerged conditions. Accutex also offers an economical unwinder for the larger spools.

❒ AgieCharmilles

This was the first IMTS for the fully integrated AgieCharmilles lines. The booth featured a large array of Wire EDM, Sinker EDM, and High Speed Machining centers.

The tapering wire guidance system offered on certain models was quite interesting. The wire guide consists of a combination of the traditional Agie vee guide constructed from intersecting diamond cones underneath a PCD toroidial ring. For tapers in excess of 3 degrees, the wire transitions from a pivot at the vee guides to wrapping around the precisely ground toroid for more precise control of the taper angle.

Also of interest was the IPG Vertex power supply, featuring gate arrays which offers substantial energy saving potential over earlier power supply generations. Its 4KW energy consumption compares quite favorably with the 20KW energy consumption of the 100D power supply. This leads to significantly lower energy bills, not only for the EDM, but also for the air conditioning system, providing a very significant payback contribution.

❒ Belmont

The Belmont booth featured small hole machines, sinker machines, and a newly introduced graphite/steel high speed mill.

An aerospace specific Aztek High Speed 5 Axis Small Hole machine featured a "stabilizer" which included a breakthrough sensing circuit for turbine blade work.

The CDM Rovella line of CNC sinkers featured the ability to scan a 3-D model of the part to automatically determine the optimum electrode undersize and power settings based upon the geometry of the model.

❒ Beaumont

Beaumont specializes in purpose built High Speed Small Hole machines.

A unique feature of the Beaumont machines is that the B axis is the head of the machine, which can rotate a total of 240 degrees about the Y axis.

Other unique features on display were:

- Ability to machine airfoil diffuser openings as well as round holes by means of an attachment that automatically grinds and qualifies a brass rod electrode.
- 2-4 micron guide changer repeatability
- 2,000 psi flushing pressure
- 3,000 rpm servo controlled spindle

❒ Current EDM

The association between Current EDM, a High Speed Small Hole specialty builder, and Methods EDM was new for this show. Current displayed a full range of Small Hole machines.

Current demonstrated an integrated video inspection system that not only inspected the drilled holes, but also provided corrective feedback to the CNC control. The video system can also be utilized to pick up existing holes in repaired turbine blades.

Current also displayed a machine with a separate Z axis that utilized pre-shaped electrodes to EDM diffuser openings.

❒ EDM Network

EDM Network displayed Wire, Sinker and Small Hole machines from Chmer EDM. The Small Hole machine was a 6-axis driller set up for aerospace blade work.

They also offer a unique large sinker that mounts two independent CNC heads on a 10 foot rail, for independent simultaneous machining of very large workpieces.

❒ Erowa

The theme at Erowa was "Back to the Future". This theme highlighted the fact that by employing non- glamorous, yet previously ignored, standardized tooling, shops are experiencing substantial production savings without the expensive leap to robotic tooling.

❒ Methods EDM

At the Methods booth, Fanuc displayed a number of Wire EDM innovations this year:

- An "inverter" chiller design for substantial energy savings
- A new control capable of directing 16 axes
- The replacement of solenoid valves with servo controlled valves for more precise tank level control with no induced vibrations
- Feedback servo tension control

Fanuc also displayed a sophisticated PCD Edge system dedicated to the production and inspection of complicated PCD cutting tools. The system consists of an integrated Hirschmann A/B axis, special software, special probe, and unique power circuits specifically designed for the efficient cutting of PCD.

❒ Harig

Harig displayed its line of Grind-All based indexers equipped with 3R Mini and Macro chucks.

While not directly applicable to EDM, I found Harig's Kool-Grind system quite interesting. The system consists of an internally cooled magnetic chuck paired with a self-contained chiller, which maintains a cool workpiece during surface grinding without the use of coolant or mists.

❒ Hermann Schmidt

Hermann Schmidt featured two products that should prove interesting to EDMers.

The three jaw (capacity .020 to 1″ & 1″ to 2″) and six jaw (capacity 2″ to 3″) self centering stainless steel chucks are designed to hold varying diameter round parts, maintaining a constant centerline within .0001″. This could be very useful for shops EDMing ground blanks, such as die bushings or mold inserts on a production basis.

The Stainless steel indexer can set precise angles without a sine plate and features ceramic bearings, a grounding system, and the possibility of submersible operation in both spin and indexing modes.

❒ Hirschmann

Hirschmann introduced a new line of submersible spin and index tables to complement their highly regarded submersible A-axis units utilized by many OEMs.

Figure #1

Unrelated to EDM, but of particular interest to "gearheads" like me, was a live display featuring a Parallel Kinematic Machine performing secondary deburring operations on castings in conjunction with a robot. A Parallel Kinematic Machine utilizes 3 pairs of computer controlled linear actuators (which look like shock absorbers) to generate the equivalent of 5 Axis spindle motion, replacing the traditional motion systems (ways, lead screws, and rotary axes) of a conventional machine tool. This concept offers the promise of a radical departure in machine tool design and construction. ***(See Figure #1)***

❒ Makino

The DUO concept for Wire EDM was one of the featured items at the Makino booth. The DUO machines offer a choice of two guide systems, separate flush pumps for upper and lower heads, dual anchors for the ball screws, dual door configurations, dual filter banks, dual threading jets, and a dual generator that features multiple spark waveforms.

Makino had an interesting display of a sinker executing a cycle consisting of an indicator touch off on a datum, then a series of X,Y,Z, and C axis motions along with tool changes, followed by a return to the datum demonstrating a repeatability of six millionths (.000006")!

Makino also displayed a Sinker EDM with a power supply specifically designed for cutting Titanium.

❒ Mitsubishi

The Mitsubishi booth featured a NASCAR theme along with a visit by NASCAR champion Tony Stewart.

The booth also displayed a Waterjet-Robot-Wire EDM cell producing a medical part. The blank was cut by the Waterjet machine and then transferred by the Robot to the Wire machine for cutting the finish geometry.

It was announced at the show that Mitsubishi will begin manufacturing its Waterjets in the USA in 2009.

Mitsubishi also promoted their High Speed Small Hole machine that features a patented power supply which utilizes a unique low voltage cutting pulse. The use of the low voltage cutting pulse significantly reduces electrode wear and the "bullet nosing" of the electrode tip normally associated with High Speed Small Hole EDMs.

❒ ONA EDM

The ONA booth featured its Modular series of large machines. By employing a modular "building block" concept, ONA is able to essentially build a machine customized to the customer's requirements from standardized components, at a considerable savings over a custom machine, or a machine that is larger than the customer's actual requirements.

ONA offerS ecologically friendly cartridge-less filter systems for both Wire and Sinker EDMs.

For Wire EDM, ONA offers the optional Aqua Prima Mineral Filtering System. This system features a layered bed of graduated mineral grains, which traps the cutting debris particles down to three microns as the water passes through it. The mineral bed is regularly back-flushed to renew its capacity, and the debris is deposited into a collection bag. This could be a boon to shops who wire cut aluminum and experience very poor filter life, due to the aluminum debris rapidly blocking off the pores in the paper filter cartridge.

For Sinker EDM, ONA offers a back-flushable paper disc system that filters the oil to one micron. The system uses an automated back-flush program to clean the discs and deposit the waste in a collection bag. The predicted filter life is an average of 10,000 hours.

❒ Sarix

The Sarix micro EDM machining centers on display in the Saturn booth featured an impressive display of advanced micro EDM technology.

The Sarix machine is essentially a very accurate micro EDM milling and drilling center, combined with a wire EDM electrode dressing module, electrode changer module, a video inspection module, along with optional A and B axes. This machine is capable of drilling, 2-D milling, and 3-D milling of extremely small details to extremely fine finishes and tolerances autonomously.

Figure #2A
"Courtesy of SNECMA"

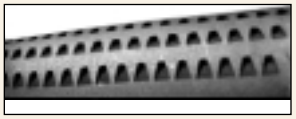

Figure #2B

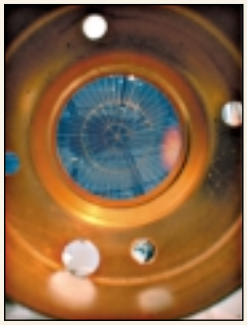

Figure #3A

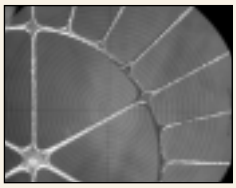

Figure #3B

One particularly interesting application demonstrated was the 7-axis EDM drilling of cooling holes for aerospace turbine blades ***(See Figure #2A)*** combined with 7-axis EDM contouring of the diffuser shape where the cooling hole meets the surface of the blade. ***(See Figure #2B)***

Another example of the process's delicate capability is a steel part that features a 3-dimensional spider web of steel produced by 3-D EDM milling away of almost all of the steel, leaving only the remaining steel web. ***(See Figure #3A & #3B)***

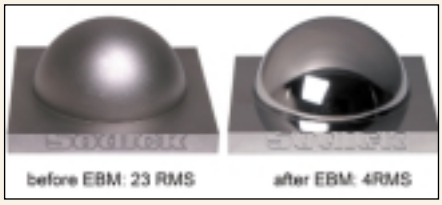

Figure #4

❒ Sodick

There were a number of new technologies on display at the Sodick booth.

The Electron Beam polishing machine is, in my opinion, revolutionary. Directing a 2.35" electron beam over the surface of the part to be polished, this machine can reduce a 23 RMS EDM finish to 4 RMS polished finish in a matter of minutes, without changing the surface dimensions. (***See Figure #4)*** For those of you who have experience with the tedious and time consuming process of hand polishing, this process has the potential to be game changing.

Sodick also displayed a Nano precision high speed mill. While not an EDM product, this machine will be of interest to some EDMers due to its unique non-traditional machining capabilities. Utilizing a 120,000 RPM spindle and linear motor axis drives with 3 nanometer resolution (One nanometer is equal to 40 billionths of an inch), it can produce nano-precision part features. A graphic example of this capability is the engraving of 110 Japanese characters on the surface of a grain of rice, each character being .006" wide by .0006" deep. ***(See Fig #5)***.

Figure #5

Sodick was also promoting a 10 year guarantee of positioning accuracy. This is reminiscent of the 10 year positioning accuracy guarantee for the legendary Moore Jig Grinder.

Last, but not least from Sodick, was the IMTS debut of the Sodick Hybrid Wire EDM Waterjet. This unique integration of a Sodick Wire EDM and a Flow International waterjet into one machine is an outstanding engineering achievement.

❒ System 3R

System 3R promoted a number of new products at the show:

- A new, low cost version of the 3R Ruler
- Improved integral vise jaw relief designs for more secure part holding
- A stand-alone rotary indexing table
- The Workmaster Linear-A track mounted Workmaster robotic tool and workpiece changing system concept, which allows it to service a greater number of machines and storage locations under a "Chaotic Loading" strategy.

Next issue: The return of Tech Tips.

Any suggestions for future topics are welcome. Tell us what you would like to read about.

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