

CASE STUDY
ONE SINGLE PROCESS "MICRO EDM DRILLING AND MICRO EDM MILLING" FOR MULTI-FIBER TITANIUM FERRULES



INTRODUCTION

The design of technology or new feature generation is nowadays so small and so precise on complexity on the technical conception, that machining still remains backwards to the practice and reality. During the last few years this evolution trend opened the door of effective conventional machining combinations. In addition, the leads of the micro parts machining have reached a level of precision and size requirements, that now handling the tools is still a critical issue. The miniaturisation of devices and micro features have been always the major topic of Diamond SA as world leader on the Fiber optical components.

OBJECTIVE AND SPECIFICATION

One of the challenge of Diamond SA have been to achieve multi-fiber optical connectors for NASA. In this case several fibers were used for a hyper spectral imaging meant to be used on Mars. The multi-fiber ferrule needed to be within a tight position within precision of 2 micron or less. Complex pattern cavities or ultra small single holes (ca. 50um) are all subject to a very high machining precision. An other major concern was also to provide a high precision vertical structure (better than a couple of microns) for the complete pattern. Their machining choice was immediately aimed to the Micro EDM Drilling associated to the Micro EDM Milling capability.



"We need to have a one step machining process creating the whole pattern or structure. The machining lead time and obviously the repeatability on the ferrules on the titanium alloy used is the key for this project" Diamond project manager

SOLUTION IMPLEMENTED

Understanding clearly the importance of the technical facts, SARIX offered its latest 3D Micro EDM Milling Technology. Using a 60 microns solid carbide electrode, the requested cavities could be realized within very tight precision of 0.001 mm including the very accurate position and concentricity of the cavity to the body of the ferrule. The constant electrode wear compensation control together with the continuous automatic electrode re-feeding allowed to complete the structure in one machining program. The slot and the structure were produced to specification. This "one setup Micro EDM machining" has been successfully applied to several other custom pattern ferrule and has been delivered by Diamond SA to the Photonics Team at Goddard Space and Flight Center - NASA.



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THE BENEFITS OF μ EDM

SARIX offers automated industrial turn-key μ EDM equipment, that compete with traditional process, while having all the advantages of the Micro EDM Machining. SARIX MICRO EDM machines demand that the operator define the work piece material, electrode material and hole depth. Once it has been set up the machine controls and optimises the process automatically. The permanent presence of an operator is not needed and the machine can work as an autonomous production cell. Parts machined through the μ EDM process can be immediately used with no additional finishing.

ABOUT SARIX SA

SARIX designs, manufactures and markets highly efficient Micro-EDM Equipment typically used in many industries such as: die-making, micro-electronics, medical, watchmaking, automotive and aerospace as well as research centres and universities. The SARIX SX-100 and SX-200 product line is designed for use in various 3D Micro EDM Machining modes offering users the highest level of flexibility including Micro-Drilling, 3D Micro-Milling and Micro-Sinking.



SARIX
 THE BEST MICRO EROSION TECHNOLOGY
3D Micro - Milling

For additional product information contact SARIX + 41 91 785 81 71 or visit us @ www.sarix.com

"Making your needs on 3D Micro EDM Machining a reality"

MACHINING VERSATILITY

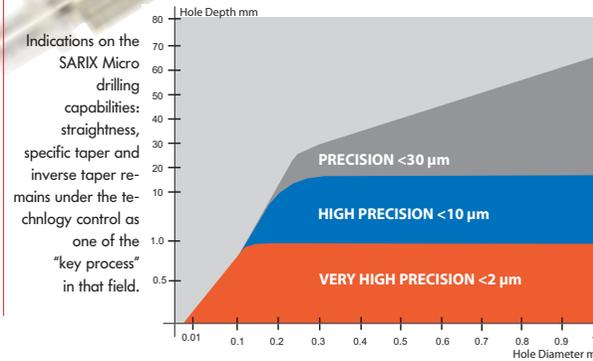
Single machine setup is good enough for full 3D Micro EDM Milling of complex parts!

SARIX machines are well know for their extreme modularity. The reason of offering a combination of micro-machining capabilities in a modular concept is to achieve a high precision level of producing entire cavity or even a set of various cavities in just a single setup. Starting from a basic high precision Micro drilling configuration, the machine can be extended at any time to perform very accurate small-scale complex 3D structures. The attraction key is the great flexibility of these "built-in" multi-processes: Micro Drilling, Micro Sinking, 3D Milling, Micro Electrode shaping, machining measurement and 3D Scope surface scanning. The beauty of the versatility of the SARIX μ EDM system has reached now tremendous effective performance on production and also on mass-production as Automotive, Medical, Watch-maker, Micro-electronic and most of it Aerospace.

μ EDM DRILLING

As world market leader on high precision μ EDM DRILLING, SARIX provides attractive and competitive solutions for very accurate, smaller and deeper holes in carbide, hardened steel advanced alloys. Nowadays, the extremely high accuracy and precision requirements on micro holes bring forward the Micro Drilling technology to new machining factors much more important than they would be in conventional drilling conditions.

The strong interactions between diameter, depth and tolerances have been now taken over through the latest SX-SLS-DT "Self Learning Software" for the drilling technology.



3D μ EDM MILLING

The basic SX machines combined with the SX-3D- μ EDM-Milling-CAM software package offers the possibility to produce high quality freeform microstructures, including geometries in "sub-micron" tolerances within surface finishing down to 50 Nano Ra 0.05 microns.



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SUMMARY OF CURRENT ISSUE

"Built-in"
NEW ARIANNE
 WireDress unit

TWIN SPINDLE

3D SCOPE
 in process optical measurement system

Case study - Diamond SA Switzerland for Nasa Multi-spectral imaging



Dear Readers,

The interest in Micro-machining grows constantly and we discover applications in many fields. In this issue we are proud to present the Micro EDM machining versatility where products machined on SARIX leaves the earth.

We focus on new integrated features for productivity and machining process control; the TWIN-Spindle combination, the new Wire Electrode Grinding Unit "SX-Ariane" with Laser measurement and the "in process" 3D-Scope device for surface and form scanning.

With the 3D Micro EDM Milling, cavity and micro parts can be directly machined in one single set-up eliminating the need to manufacture complex electrodes from roughing to fine finishing. The entire machining part can take place in a single set-up without intervention.

TWIN SPINDLE

The Twin Spindle provides machine users additional improvements to increase the productivity by reducing the machining time of the Micro EDM Drilling and the Micro EDM Milling.

As for conventional mechanical Milling, the 3D Micro EDM Milling process needs also different sizes of electrode tool to produce the whole miniatures cavity. The roughing operation is used with larger electrode size.

FEATURES & BENEFITS

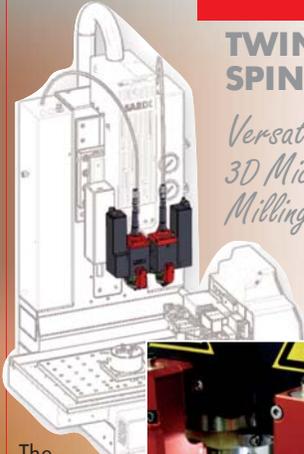
Cycle time reduction
up to 50%

Productivity and
machining autonomy

Double electrode size down
to 45 microns

TWIN SPINDLE

Versatile
3D Micro
Milling



The finishing with solid electrode down to 45 microns brings the efficiency of the process to an entire complete single machining setup.

The combination of the twin spindle with the electrode Wire Dressing unit SX-Arianne, opens also the possibility to create intermediary size needed for the path of the cavities. Together with the Twin Spindle, it works simply as a tool size exchanger.

In few words the Twin Spindle feature increase the productivity by adapting the electrode tool to the several steps of the Micro machining.

3D-SCOPE "in process" benefit

The machining quality control during Micro-Milling process might be a useful function. There is no machining without measurement. This rule is definitely the main issue of the micromachining field where micro-size are real challenge.

With its new SX-3D Scope, SARIX offers the quality insurance of measuring micro parts directly on board of the machine, thus without undamping the part, even at each intermediary steps.

WHY MEASURING?

All EDM machining needs to be measured, the better way is to have it included in the machine. The electrical touch measurement with the electrode at any machining step can reach on the SARIX machine an accuracy of about 3 microns. However the needs of certain manufacturers are nowadays higher. In between machining step process hole size, roughness, size, structure heights are important before the final execution or for certification.

The 3D-Scope optical measurement is the right solution to cover the "touch device" measurement. The main advantage for the "in process" measurement is the full interaction machining which can be implemented at any point of the machining program.

MEASURING CONCEPT

The **SX-3D Scope** is a non contact white confocal light microscope type enabling to scan whole machined cavity. The resolution of the measured distance between the scanning head and the work piece surface is of +/- 0.1 micron where the X,Y relies to the machine accuracy.

The further use of the **SX-3D Scope** helps to check either surface finish or dimensions. Modelling pre-machined solid piece can be scanned and checked with the machining interface program to the **SX-3D-μEDM-Milling-CAM** software.

- "in process" 3D surface and cavity measurement
- Roughness measurement down to Ra 0.05 microns
- Height profile and structures evaluation
- Reconstruction of surface models and CAM import files
- Topographic view and profil of resolution of +/- 0.1 micron

THE BEST MICRO EROSION TECHNOLOGY
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3D Micro - Milling

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FEATURES & BENEFITS

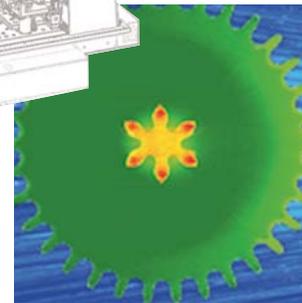
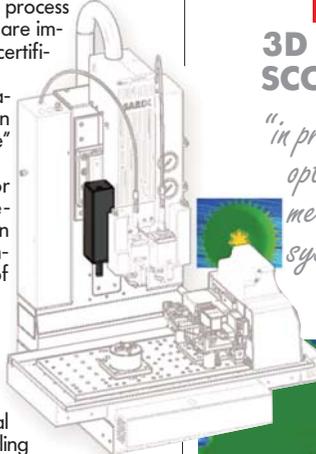
Major accuracy
and greater repeatability

Automatic diameter and
run-out measurement

Electrode profile
and geometry

3D SCOPE

"in process"
optical
measurement
system



SX-ARIANNE Wire Dress Unit

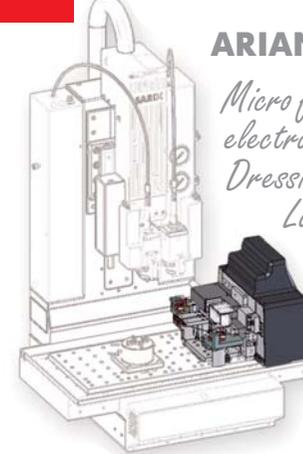
The Wire Dress Unit or Wire Electrical Discharge Grinding device (WEDG) is essential for the milling and the micro machining works. It shapes the electrode tool on the same machine where the part is produce, thus achieving and keeping the accuracy between each operation.

SARIX has redesigned his proven Wire Dress feature to increase the accuracy and to include the latest innovations of the measurement technology.

The product named ARIANNE, is very accurate, easy to setup and to operate within the laser measurement system. Further electrode profile can be displayed on the machine screen.

ARIANNE

Micro fine
electrode Wire
Dressing with
Laser
control



FEATURES OF THE SX-ARIANNE

The new design contributes to improve the accuracy of micro-grinding operation of the electrode tool ensuring a better overall performance of the **SARIX μEDM** machines. Keeping the same basic concept of the previous WEDG unit, the compact Wire dress unit **SX-ARIANNE** offers the following new features:

- Superior mechanical and thermal stability with precise spooling control of the wire avoiding any jerks.
- Automatic control of the wire tension minimizing wire vibration.
- Choice between "Micro-Touch" or Laser measurement device (option)
- Electrode run out check and electrode profiling software (option)
- Accuracy +/- 0.15 microns

The **SX-ARIANNE** is fully compatible with the existing **SX-100** or the **SX-200** machines. The Laser unit is also available as stand alone unit, not combined with the Wire Dress Unit.

