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1 *Sonodrive300 with control unit*
2 *Sonodrive300 while dressing an electrode*

SONODRIVE300: FORMULA 1 IN µ-EDM DRILLING

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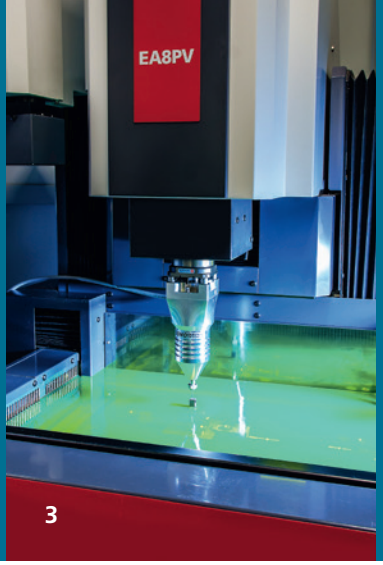
Introduction

Increasing complexity of product designs and processes requires higher quality, precision and diversity in machining technologies among considerations of economical aspects, to survive in the global competition.
The patented innovative EDM-spindle Sonodrive300, developed at Fraunhofer IMM, combines high precision rotation with a high frequency vibration in one unit, to increase the efficiency of the precision EDM drilling process compared to conventional EDM drilling devices.

Motivation

The realization of precision small and micro parts as well as small structure elements leads to a higher demand of EDM as a manufacturing process. The use of EDM contributes several advantages but also some machining challenges. Particularly, the evacuation of already removed material particles out of the active discharge area is critical and ultimately may lead to abnormal termination of the EDM process. Especially the use of small and micro electrodes to realize delicate work piece structures requires the smallest discharge energies and leads to small discharge gaps and material debris on the micro and nano scale. Common flushing methods are not effective in this work environment and new solutions are necessary. Numerous tests pointed out that high frequency vibrations on the electrode in z-axis direction causes current flows in the discharge gap, so material debris can be washed away. This finally leads to a consistent EDM process, whereby machining time will be reduced significantly by partly less electrode wear.



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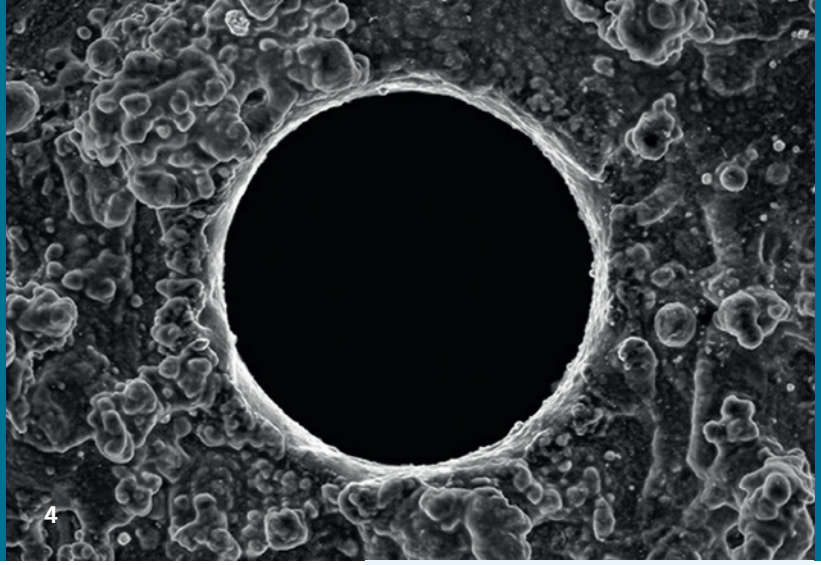

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The combination of rotation and vibration in one unit additionally increases the precision of the machined hole, such as roundness, and improves the uniformity of the electrode wear.

Integration into an existing machine system

The Sonodrive300 spindle is designed as an add-on device and fits to commercial EDM die-sinking machines by using the installed electrode clamping system. The Sonodrive300 unit can be equipped with any commercially available fixuring system. Custom designed connections to machines for special applications can also be realized. Due to the included and self-sufficient spindle controller, no intervention to the existing machine controller is required, so we can thoroughly entitle the Sonodrive300 system as a Plug´n´Play unit.

Target group

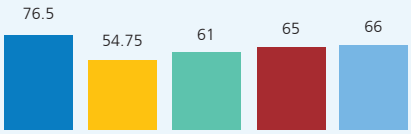
The current version of the Sonodrive300 system is primarily designed for Mold- and Die-industries as well as for precision parts manufacturing.

Application areas

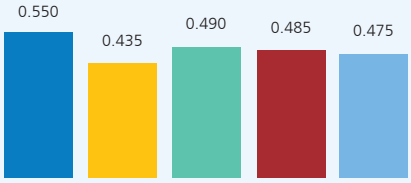
- Microhole creation with a diameter ≤ 0.15 mm, while using solid electrodes
- EDM microhole machining with poor flushing conditions
- On-machine manufacturing of rotation symmetrical electrodes; advantage: no unclamping or transformation of electrodes, therefore no error caused by runout and no stagger
- Direct machining of precision components for prototyping, single part or small batch machining
- Increasing capabilities of commercial die-sinking EDM

Drilling test on EXERON EDM 313
dia. 0.2 mm; t=0.8 mm
Material: 1.4310; rot. speed 1200 rpm

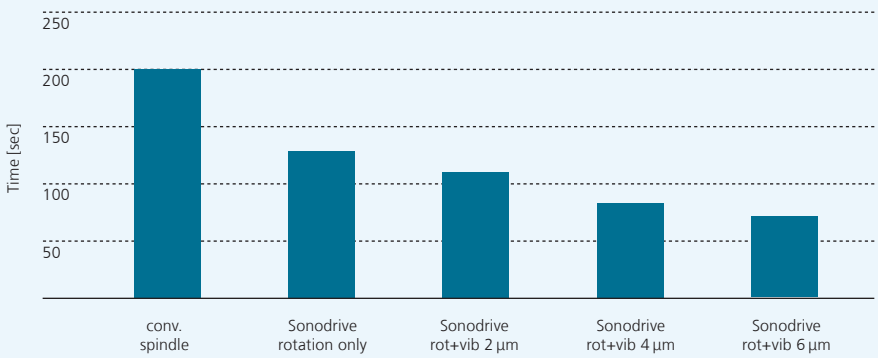
Machining time [sec]



Electrode wear [mm]



Test-Sonodrive, hole diameter 0.2 mm, machining depths 1.0 mm, machine: Mitsubishi EA12V



References

E. Reiff, S. Arnold, F. Neumann: *Schneller Erodieren mit Vibrationsbohrspindel.* Distributed in: *Mikroproduktion,* 04/2014.
S. Kunz: *Die Zukunft im Blick.* Distributed in *Mitsubishi Electric Profil,* 02/2014.

3 *Sonodrive300 installed on a Mitsubishi EA8 PV*
4 *Microhole dia. 30 µm, machined on Mitsubishi EA12V advanced in combination with Sonodrive300*