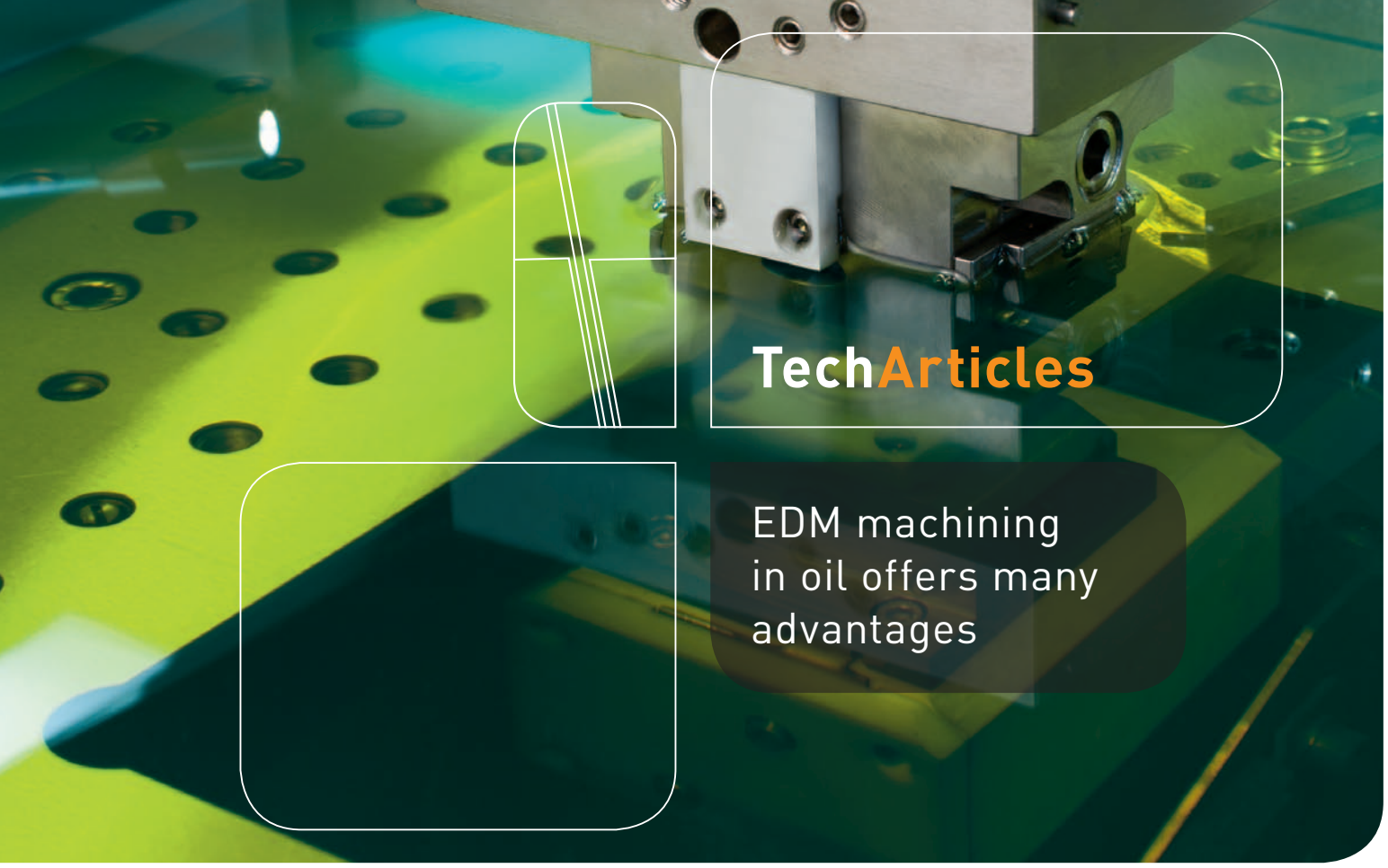


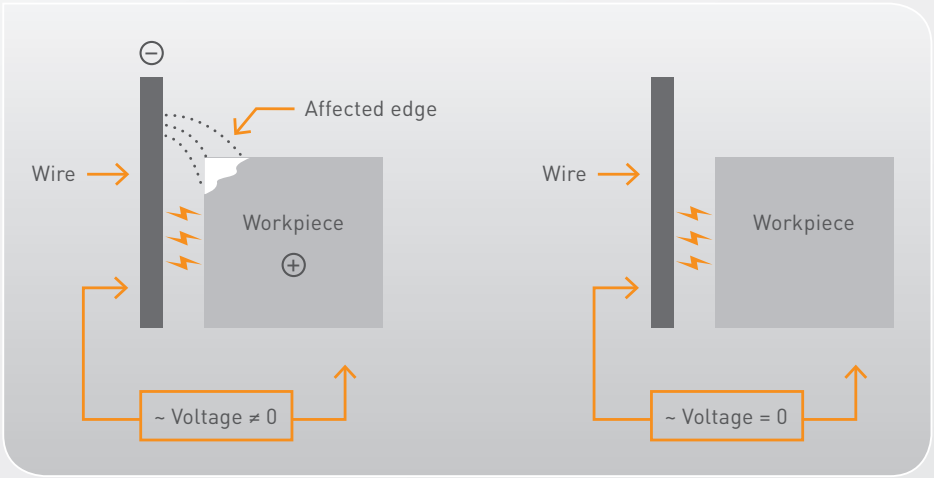
TechArticles

EDM machining in oil offers many advantages

+GF+ AgieCharmilles

CORROSION

The active parts of stamping tools (cutting tools) are most commonly machined through the wire EDM process.
The materials used for such tools tend to be optimized to make the tool life longer. Thus, materials such as tungsten carbide or other high-hardness materials are used today in many cases.
The development of these types of materials needs to include additional components used as binders for carbide grains or others during the sintering process. These binding elements (e.g., cobalt) are sensitive to corrosion and are therefore affected by all electrochemical reactions or simply by the external environment (natural chemical reaction).
Conventional machining by wire EDM using water as a dielectric leads to this type of phenomenon.



During such machining, two phenomena can be observed:

- The phenomenon caused by the electro-chemical reaction between the wire and the workpiece in an aqueous environment will enable the pitting of the surfaces of the work-piece including the cutting edge. Thanks to the specific management of the spark and in particular the use of the digital generator present on all of our machines, GF AgieCharmilles eliminates attacks in electrochemical machining by using an average voltage (wire electrode/piece) equal to 0 (anti-electrolysis generator).

- The second phenomenon is the natural corrosion of the surface which has the effects of weakening the cutting edge as well as the active surfaces of the punch and the die. Indeed, the smallest defects generated by the surface stress to the local heating during the spark erosion will lead to a propagation inside a material known as "cavernous" corrosion (see Fig. 4), often invisible but very easy to identify after cleaning or abrasive blasting.

WORKPIECE MACHINED AND LEFT IMMERSED IN WATER

The first phenomenon can be avoided by the use of the anti-electrolysis (AE) generator which does not affect the workpiece. Deionized water corrosion is minimized by removing the finished part within a reasonable period of time after the end of machining (<5 hours). Programming the start of machining (immersion of the workpiece) and thus the end time of the program will allow removal of the workpiece from the bath before it harms the final quality

The easiest way to master the corrosion phenomenon is to use a neutral dielectric like oil when possible.

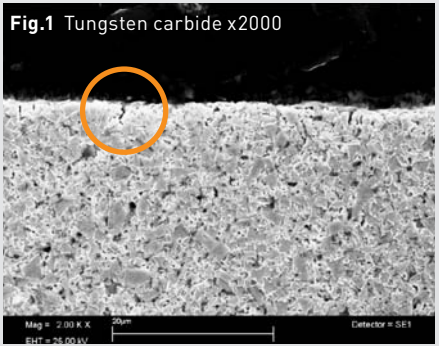


Fig.1 Tungsten carbide x2000

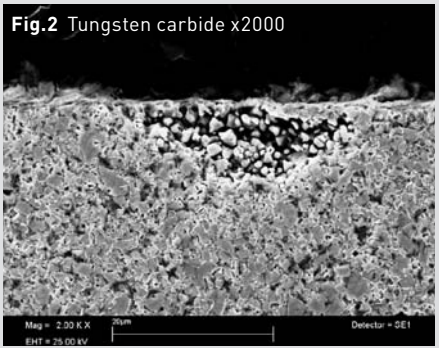
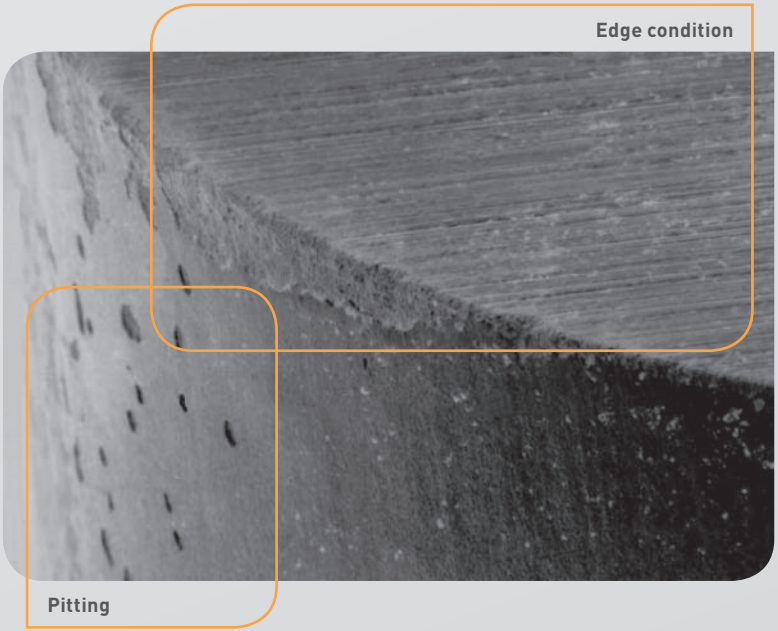
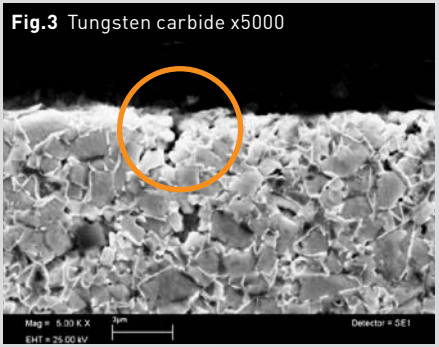
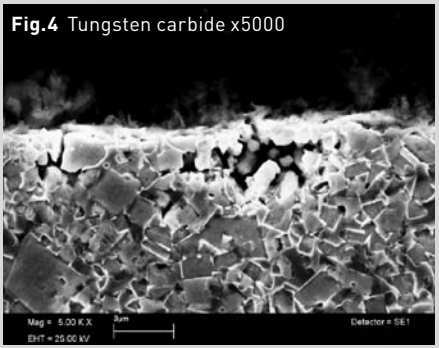


Fig.2 Tungsten carbide x2000







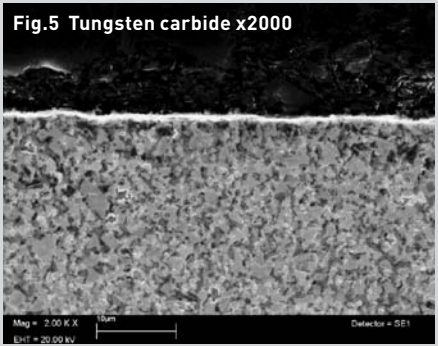
WORKPIECE MACHINED AND LEFT IMMERSED IN OIL

The main disadvantage of machining in this dielectric is a loss of competitiveness due to lower cutting speeds. This is mainly due to the reduction of the gap width which consequently does not sufficiently cool the wire during the main cut.

GF AgieCharmilles refusal to compromise is demonstrated by the new, high precision CUT 2000 Oiltech and CUT 1000 Oiltech with a unique Automatic Wire Changer (AWC). This system makes it possible to machine with faster or larger diameter wire during roughing and finishing to mitigate the oil dielectric's affect on speed.

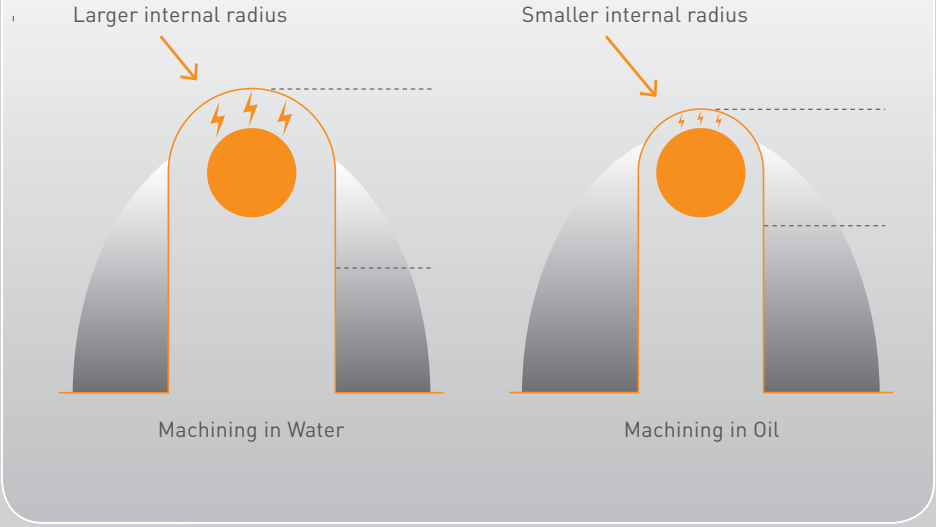
Moreover, these machines are used to obtain accurate details unequaled in the market with the ability to use the perfect wire for the sharpest details.

It has to be noted that many so-called "exotic" materials, such as polycrystalline diamonds (PCD) and ceramics, require the same type of protection during the EDM machining process and therefore also require the use of oil dielectric.
It is clear that at the same time, the machining of more common materials such as steel will benefit, thanks to the non-corrosive dielectric.



EFFECT ON SURFACE FINISH

An advantageous side effect of machining in oil is the necessity to machine with a very small sparking gap. The direct consequence of that specificity is the possibility to make small details with bigger wire compare to water machining. This very small gap means you can work with a low power setting and get a very good final surface finish (Ra 0.05 or even less depending of the carbide machined).



At a glance

Achive more

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to obtain competitive results.
When our customers win, we win.

GF AgieCharmilles

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