Carbide cutting: Oil-based wire EDM is also advantageous for shops cutting carbide parts and facing similar water-absorption issues as shops cutting fine-mesh materials do. Water-based EDMing has adverse surface conditions caused by the water in the dielectric tank, so carbide parts must be dried as soon as the part is completed to prevent corrosion. An oil-filled dielectric tank eliminates these problems.

When carbide parts are left in dielectric water, the amount of water the parts absorb depends on the density level of the particular type of carbide. Once water is absorbed, corrosion can occur deep inside certain carbide types. This corrosion permeates way beyond an EDMed or ground part surface and is undetectable with simple visual inspection. As this corrosion grows, it jeopardizes the integrity of the finished part.

Micromachining: For shops micromachining parts for nano applications, oil-based EDMing allows them to successfully generate precise and clean part surfaces. This is critical when secondary cleaning or polishing operations are not an option on parts that are too small to handle.

**Top Photo:** A dual-wire wire EDM uses oil as a dielectric to improve EDM operations, especially when cutting carbide parts.
Oil-based wire EDMs have been around for a while, but didn’t readily catch on because their cutting speeds were a bit slower than those of water-based wire EDMs. However, shops that weren’t so concerned about cutting speeds would use oil-based machines instead of water-based ones to eliminate the problem of corrosion buildup on parts left in machines overnight or for long periods of time.

In general, water-based wire EDMs have always delivered better cutting performance using small (< 0.004”) wire diameter because the water cools the spark gap much faster, allowing machine users to apply higher cutting currents to increase cutting speeds.

However, now some oil-based wire EDMs can cut at the same speeds as water-based machines. This is the result of advancements in EDM generator technology, such as the high-performance generator a new oil-based wire EDM for micromachining. Besides this special generator, other proprietary machine advancements to boost cutting speeds are incorporated.

Another challenge EDM builders faced with oil-based machines for micromachining was adapting automatic wire-threading capabilities. On water-based wire EDMs for micromachining, automatically threading extremely small wire diameters is easily achieved, but trying to automatically thread them through oil’s thicker viscosity took some new technology.

For example, a new oil-based wire EDM equipped with the only dual wire system can use wire that is 0.0008 in. in diameter, and it includes an automatic wire threader specifically designed for it. This threader allows that size wire to pierce the oil’s surface. The system has proven to provide consistently reliable automatic wire-threading cycles.

Cost Comparison
When comparing the operating costs of a water-based wire EDM to those of an oil-based machine, operating costs of the oil-based machine may be a bit higher in the first year of operation. However, in the years following, those costs are measurably less than with a water-based machine.

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In the first year of operation, oil-based EDMs involve initial cost outlays for dielectric tank oil, and as recommended by most EDM builders, fire extinguishing systems—such as those used on die sinking EDMs.

What makes oil-based wire EDMs less expensive to operate after the initial year of operation is the fact that they eliminate the need for deionization resin bottles because oil does not break down like dielectric water does. Frequently changing deionization resins can be costly, especially true for shops that must maintain low water conductivity levels essential to achieving superior surface finishes. Keeping conductivity levels low (5µS) requires frequent resin changes.

Similar to water-based wire EDMs, oil-based wire EDMs also require filtering of dielectric fluid. Oil-based machine filters are the same as those used on die sinking EDMs. But, the wire EDM filters typically last longer than die sinker filters due to the fact that the micromachining wire EDM process generates fewer particles and material removal rates are lower.

Summary
As part sizes shrink to meet new and existing industry requirements, the use of oil-based wire EDMs for micromachining will continue to spread. It is widely known that the machines have quickly caught on in Asia and Europe. Many EDM builders believe that the emergence of today’s technologically advanced oil-based wire EDMs is an opportunity for the average U.S. mold builder to set himself apart from the competition.

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