An Added Layer of EDM Knowledge

Improve EDM performance by understanding electrode material selection and the relationship between the electrode, workpiece material, and machine parameters

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EDM TECHNOLOGY

Sinker EDM technology has improved significantly over the years, changing many of the processes and decisions that an EDM operator will face when operating the machine. Even though operators may have access to the latest in machine tool technology, it is still important for them to receive training to understand machine parameters and the impact each one has on the finished product.

Most EDM training is separated into basic and advanced levels of operation and covers topics such as EDM theory, preventive maintenance, operational practices, programming, and advanced technologies. However, these are primarily focused on the EDM sinker machine itself and not on the consumable materials associated with the machine such as the dielectric oil used in the EDM process, the filters used to keep the dielectric fluid clean, and even the electrode material used to complete the burn.

Did you know that the electrode material used in the EDM process has a direct correlation to the performance and efficiency of the EDM burn? This is similar to the food we eat and how much exercise we get to maintain good health and remain at the best physical condition possible. If we eat healthy and exercise, then we can expect to have energy and fewer illnesses than if we were to consume mostly junk food and live an inactive life.

In this same regard, the electrode material used in the EDM burn must be matched to the application to guarantee success at the highest level of productivity. Sure, even the incorrect electrode material can complete the job, but at what cost? To ensure the most effective operation, everyone from the shop owner to the machine operator should receive training on the impact the electrode material has on the EDM process. Supplementing training by the sinker OEM with electrode material training will add a layer of knowledge to the EDM operator, which they can apply to better maximize machine productivity.

There are five main factors of electrode material selection that can impact EDM performance and serve as a basis for the training you should offer your EDM operators.

MACHINABILITY

Any machinist who has ever machined graphite is aware that it cuts very easily. Simply being easy to machine does not necessarily make a material the best choice for an electrode. It must also be strong enough to resist damage from handling and the EDM process itself. Strength and small particle size are also important, so that minimal radii and close tolerances can be achieved. Because harder electrode materials are more prone to chipping during the machining process, material hardness is also an important consideration in graphite machining.

METAL REMOVAL RATE (MRR)

MRR is usually expressed as cubic millimeters per hour (mm^3/hr) or cubic inches per hour (in^3/hr), but could just as realistically be expressed as dollars per hour ($/hr). Achieving an efficient MRR is not simply a matter of having the right machine settings, it also involves direct energy dissipated in the EDM process. Graphite is generally much more efficient than metallic electrodes, however metal removal rates vary widely between graphite types. With the proper electrode material/work metal/application combination, MRR can be maximized.

WEAR RESISTANCE

There are four types of electrode wear: volumetric, corner, end, and side. Of the four, corner wear appears to be the most important since the contours of the final cut are determined by the electrode's ability to resist the erosion of its corners and edges. It follows that if an electrode can successfully resist erosion at its most vulnerable points, then overall wear will be minimized, and maximum electrode life achieved. Electrode erosion cannot be prevented, but it can be minimized by choosing the proper electrode material/work metal combination and machining at the optimum settings.

The ability of any electrode to produce and maintain detail is directly related to its resistance to wear and its machinability. Minimizing corner wear requires choosing an electrode material that combines high strength with high temperature resistance.

SURFACE FINISH

Fine surface finish is obtained with a combination of the proper electrode material, good flushing conditions, and the appropriate power supply settings. High frequency, low power, and orbiting produce the best finish because these conditions produce smaller, less defined craters in the work metal. The final surface finish will be a mirror image of the electrode's surface. This means that graphite grades with a particle size of less than 1 micron and have very high tensile strength, isotropy, and uniform structure, or those with a particle size from 1- to 5-micron isotropy, uniform structure, and high strength would be optimal choices for finishing electrodes.

MATERIAL COST

Generally, electrode material cost represents only a small part of the total EDM job cost and is often overlooked when calculating total job costs.

Fabrication time, cutting time, labor, and electrode wear are all factors that depend on the electrode material more than on any other factor. So, it is critical that you know the properties and performance characteristics of the available electrode materials, so you can fully understand how they can affect the work metals being machined. This data is essential when doing a cost/performance analysis to determine the true cost of an EDM job.

Regardless of the machine you are using, each of these performance factors will be impacted by the electrode material you choose. Whether the job calls for a specific surface finish, electrode wear or MRR, a consistent effective electrode material is critical to achieving the desired result.

Be sure to contact your electrode material supplier for more information on how to attend an EDM training session to learn more about how the electrode performance will impact EDM efficiency so you can better control the EDM process to achieve predictable results.

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