

Review of Recent Trends in Wire Electric Discharge Machining (W- EDM)

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ABSTRACT

In this current analysis, Wire-Cut Electrical Discharge Machining (WEDM) is an electrothermal production procedure in which a thin metallic wire along with de-ionized water enables the wire to cut through metal utilizing at from electrical sparks. The wire is usually created of brass or stratified copper, which is between 0.02 and 0.33 mm in diameter.

Since the creation of electric discharge machining, EDM wire has been a required tool in manufacturing. Then, just like today, EDM wire is necessary as an electrode that can be cut via metal by spark discharge. Regardless, various EDM wires have precise properties that are significant to assume before choosing. When picking the best type of EDM wire for your application, it's crucial to consider factors like tensile strength, surface area per unit length, diameter, and shape.

Keyword: - Wire EDM, WDEM Wire types, Recent Trends in Wire Electric Discharge Machining

1 INTRODUCTION:

Wire EDM machining is an electrothermal production procedure that utilizes electric discharges to withdraw material from a workpiece. It is an advancement to the traditional EDM method, compatible with nearly all conductive materials, and can make complicated designs and shapes.

As a result, numerous parts manufacturers across several industries utilize it, as it is highly suggested in numerous CNC machine stores.

Wire electrical discharge machining is a non-contact subtractive manufacturing procedure that utilizes an electrically charged thin wire with a dielectric fluid to cut a metal part into various shapes.

The process makes small chips and accurate cut lines by softening or vaporizing the material instead of cutting it. As a result, it can conveniently machine parts unfit for conventional machining methods. Yet, the parts must be electrically conductive.

2 LITERATURE REVIEW:

Recent developments in WEDM technology have focused on improving the efficiency, accuracy, and speed of the process. One of the significant improvements is the use of multi-axis machines that can cut complex shapes with high precision. These machines use multiple wires and electrodes that work together to cut intricate shapes without the need for manual intervention. Another significant development is the use of ultrasonic vibrations to improve the cutting speed

and accuracy of the process. Ultrasonic vibrations reduce the surface tension of the dielectric fluid, allowing the wire to cut through the material more efficiently.[1]

Wire-Cut Electrical Discharge Machining (WEDM) is a non-conventional machining process that uses electric sparks to erode the material. Recent developments in WEDM technology have focused on improving the efficiency, accuracy, and speed of the process. WEDM technology has a wide range of applications in various industries, including aerospace, automotive, medical, and electronics. The precision cutting and shaping of hard materials make WEDM a popular choice for producing intricate parts and components.[2]

3 . EDM WIRE SIZE

When you're operating with EDM, you have to be cautious. Numerous things can go incorrect; if they do, you'll have a damaged part and days of lost time- scrappage of both time and material.

You've likely listened that a good wire is a key to good finish and accuracy—and that's true. But there's more to it than just selecting the diameter: you have to think about what type of power your workpiece requires.

Here's how it works: the higher the power setting on your machine, the quicker it can cut through metal. That signifies that thinner wires need lower power settings and more extended machining times. Hence, for most machinists, utilizing a thin wire is not favored because they want their machining time to be as low as feasible.

Wire EDM develops an electrical discharge between the workpiece (metal) and the wire for the EDM machine, as the wire is constantly fed. This melts and cuts the metal in a way identical to a fret saw.

The diameter of the wire is chosen according to the shape and thickness of the metal to be machined. A wire of 0.1 to 0.3mm in diameter is generally utilized. The metal to be machined is melted and cut by the discharge, but the wire is partly consumed at the same time, as a discharge trace is created. (The trace is made when the wire surface melts and splatters.)

The somewhat consumed wire has low strength to withstand any substantial tension. Thus, the new wire must be constantly supplied. The wire is sold on a bobbin so that it can be continuously supplied during EDM.

4. TYPES OF EDM WIRE

There are a few respects to make when considering the type of EDM wire you'll utilize for a project:

- The kinds of materials can it cut through?
- What type of coating does it have, if any?
- Its tensile strength

Let us take a look at the various types of EDM wire-

Hard Brass Wire

As a wire-cut technician, you know that hard brass is the best material for roughing and skimming cuts.

Hard brass has up to aggressive dielectric flushing, so you can use a higher voltage to the wire without breaking it. And that means faster cutting rates. But what if I told you there was another cause hard brass is the best? It may sound stupid. But what if hard brass also assists you cut complex metals?

That's correct—harder metals like tungsten carbide were notoriously resistant to EDM methods until now. machinists can use EDM methods to cut tungsten carbide more efficiently.

Zinc-coated Brass Wire

Have you ever wondered about zinc-coated brass wire? If you haven't, now's the time to change that!

Zinc-coated brass EDM wire is pretty awesome. The coating acts as a guard against heat. If you're operating with brass wire and you don't want the heat to harm it, the zinc-coated wire will assist shield the wire from damage.

You might be wondering how this works just. Zinc has a lower melting point than brass, so it boils away first and takes in heat. Melting zinc aids keep the brass from overheating. With zinc-coated wire, less heat enters the wire, averting harm to your workpiece.

Coated EDM wires also achieve better machinery. Zinc-coated brass has a rougher exterior finish than plain brass wires. The coated wire gives you even surface finishes that enhance flushing and boost speed. You can get a 10 to 15% speed advancement—compared to plain uncoated wires!

High-Speed wire

You’ll often hear technicians talking about high-speed EDM wire or stratified wire. Such wires are nothing but wire with a copper core and a defused zinc outer layer.” It has the electrical conductivity of copper, which means it can cut at twice the speed of other types of wire. Nevertheless, it’s also twice as costly as various types. Plain copper wire is rare because it’s too soft and too costly. You will want to utilize this kind of wire for harsh cuts.

No matter which type of EDM wire you choose, please remember that you can utilize it only once. The wire- cutting procedure degrades the wire. Nevertheless, it can still be recycled and sold for waste metal.

Soft Brass Wire

Brass is a perfect option whether you like to cut metal or shape it. Brass has been utilized in metal manufacturing for more than 5,000 years and persists to be a famous metal for numerous applications.

For cutting metal, you can utilize 0.010-inch diameter brass wire. This plain brass wire is the most typical type of wire utilized in EDM work—over 80% of EDM work uses this type of wire.

You can utilize soft brass wire to cut tapers because it has lower tensile strength. Hence, it won’t break as fast if you try to cut at an angle.

5. WIRE TENSILE STRENGTH

According to an EDM wire professional- there are three things to think about when selecting an EDM wire: tensile strength, elongation, and linear density (weight per unit length).

These three properties determine how much force

is required to cut through a certain material by pushing the wire sideways in the cut zone between the electrodes. “The forces concerned with cutting change instantly with tensile strength, so less energy is required if you have a wire with higher tensile strength.”

One of the essential things to know about EDM wire is its strength. The tensile strength measures the stress that a material can control before it breaks. The lower it is, the easier it is to crack down.

The wire-cut machine preloads the tension onto the wire. The wire may not touch the part during cutting. Yet, the machine’s wire drive feed mechanism pulls it. We can raise or lower the tension relying on the cut.

6. SURFACE FINISH AND EDM WIRE STRENGTH

The connection between surface finish and EDM wire tension can be important for technicians. It would assist keep the wire tension down when rough cutting so the machine can cut fast without breaking the wire.

When skim cutting, you require to raise the wire tension, which means slower speeds and lower voltage in the machine. Such settings let you complete the maximum surface finish and precis.

7. FINDINGS

Most commonly used materials for gettingbest outputs:

Ref. No	Workpiece Material	Material size	Wire Material
[3]	super-alloy Inconel 718	20 mm square bar of 1.5 feet long	brass
[4]	Titanium Alloy Ti-6Al,-4V And Ti-6AL-7NB	10 mm diameter ball	Cupper Titanium
[5]	SS 316	15mm square bar of 1.5feet long	copper, brass, tungsten
[6]	D2 tool steel	200mm× 25mm ×10mm size	Zinc-coated copper
[7]	S7 heat treated steel	0.660, ±0.003, inches	brass
[8]	M2-HSS, material	5 mm thick	dielectric and molybdenum
[9]	AISI 304L stainless steel	1mm sheet metal	Copper
[10]	anitol shape memory alloy,Ni55.8Ti	1.5 mm	molybdenum

CONCLUSIONS

In conclusion, remember that the wire is the most essential component when utilizing an EDM machine. It's what creates the EDM machine go! For best results, consider your workflow and the end goal of your job. Your wire's shape, size, and material should rely on maximizing efficiency and preserving time. By creating these respects and knowing which kind of wire is right for each job, you can save time, money, and hassle both in the short and long term.

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