Chapter 8
Electrical Discharge Machining Parameters and Dielectric Fluid: A Review

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ABSTRACT

This chapter describes the basic working principle of electrical discharge machining. The impacts of both significant and insignificant machining parameters were also detailed. Also, the purpose, properties, and types of dielectric fluid were discussed to better understand the process. This chapter is concluded with describing the benefits of flushing with its types. The rapid impedance of cold dielectric fluid causes an explosive evacuation of molten metal from the electrode and workpiece surfaces. This results in the formation of a tiny crater on the surfaces of the two conductors, which hardens hollow balls of material that are subsequently drained from the gap by the fluid.

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1. INTRODUCTION

In the thermal erosion machining technique known as electrical discharge machining (EDM), metal is removed from workpieces by repeatedly generating electrical discharges between the tool electrode and the conductive workpiece in the presence of a dielectric fluid medium. Between the electrode and the workpiece, there is a voltage gap where this discharge takes place. The dielectric fluid medium then washes and flushes the vaporised, microscopic workpiece material particles from the gap after they have been heated by the discharge (Ho et al., 2004; Jameson, 2001).

EDM is sometimes referred to informally as burning, die sinking, spark machining, and wire erosions. Each is used to create both huge objects like aircraft body pieces and automotive stamping dies as well as very small and precise bits. EDM is most frequently used in the manufacture of dies. Steels that have been toughened and heat-treated, carbide, polycrystalline diamond, titanium, hot and cold-rolled steels, copper, brass, and high temperature alloys are among the materials that can be worked using EDM (Benedict, 1987; Klocke et al., 2004).

Existing electrical discharge machining applications in production are numerous; they are only waiting to be discovered and used. Despite both a mix of awareness and process expertise, the rising use of electrical discharge machining in manufacturing will continue to develop and transform as a result of this. Electrical discharge machining will assist and support the push to quality, cost, and delivery in the production process, where there is typically always room for improvement. Understanding electrical discharge machining will enable designers to create items that are neither practical nor economically feasible to fabricate using any other method. Engineers and manufacturers will continue to be fascinated by the idea of machining complex forms in harder or exotic materials to create more difficult parts and profiles. The material must be electrically conductive in order to be processed using the electrical discharge machining technique.

EDM has advantages that include:

- EDM is a non-contact method that produces no cutting forces, enabling the manufacturing of small, delicate components.
- It also produces edges without burrs and allows for the creation of intricate features and better finishes.
- EDM machines with integrated process knowledge enable the manufacturing of complex parts with minimal operator involvement.

EDM has several drawbacks, including:

- Lead time is required to develop unique, consumable electrode geometries
- Low metal removal rates compared to chip milling.

Ram EDM involves attaching an electrode to a ram that is connected to one pole, often the positive pole, of a pulsed power source. The negative pole is attached to the workpiece. Following that, the work is set up with a space between it and the electrode. The dielectric fluid is then pumped into the gap. Thousands of direct current impulses per second start to pass the gap as soon as the power source is turned on, which starts the erosion process. The spark temperatures produced can be in the 7,000–11,000 °C range. The electrode advances into the work while keeping a constant gap dimension as the erosion progresses.

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