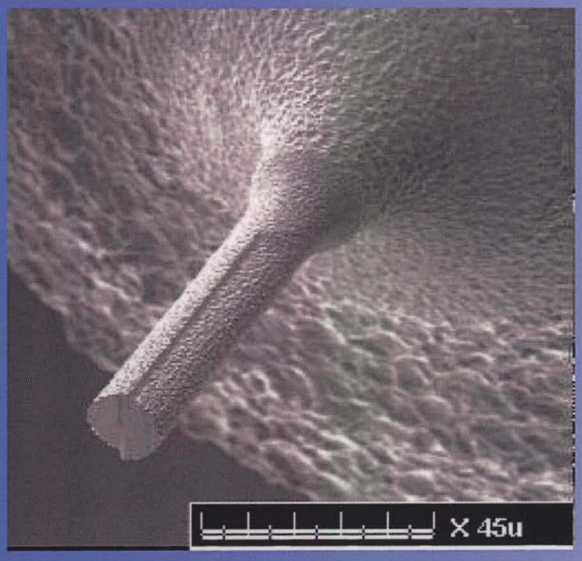
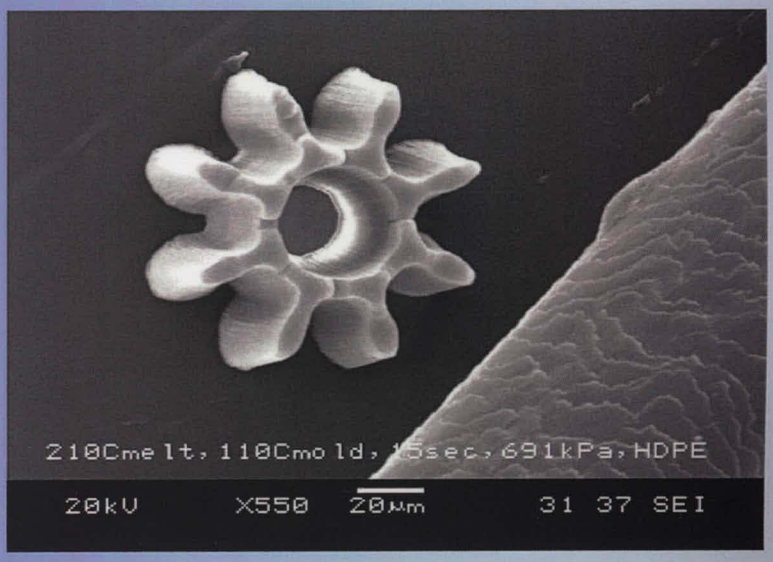
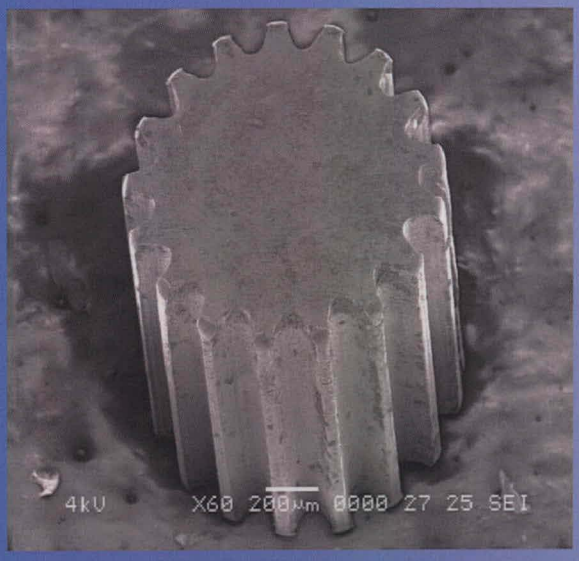
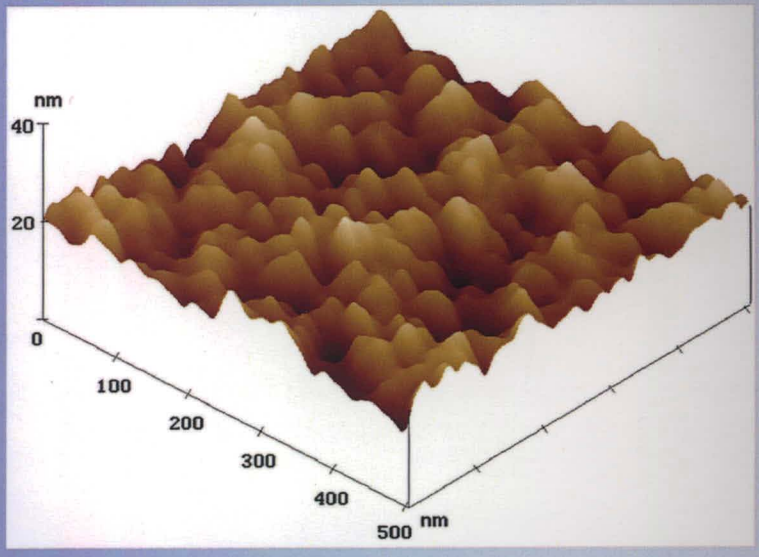
Advanced Machining Process









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Chapter 1

Tool Wear Rate during Electrical Discharge Machining (EDM) with Eccentric Electrode

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Keywords: EDM; Tool wear rate; spindle speed; feed rate

Abstract. In this chapter the influence of spindle speed and feed rate on electrode wear rate has been described during EDM with an eccentric electrode. It was found that both spindle speed and feed rate causes increase in electrode wear rate.

Introduction

Electrical discharge machining (EDM) is a manufacturing process where electrical discharges are used to get the desired shape of a workpiece. It is a thermal process that removes material with heat energy. The tool (electrode) is brought close to the workpiece surface and the gap is filled with dielectric fluid. When the transistor bank is triggered by the timing control (Fig.1), the potential polarizes a path over which direct current from the power unit (such as a generator or rectifier) flows as spark between the closest points of the electrode and workpiece. Metal is melted and expelled where the spark strikes the workpiece.

The tool is given a pulsating motion to avoid dwell of the arc in one spot for too long and help flush away the liquid. This allowed the used of more current and a higher metal removal rate. Instead of being fed straight in, the tool can be orbited on some machines, that the tool is rotated about an eccentric axis to sweep a shape larger than itself. On some machines, the tools can be moved in square or rectangular paths or straight lines as they are fed into the work. Orbiting helps the EDM action by stirring and flushing the electrolyte and distributing wear on the electrode, enhancing accuracy and finish.

The fluid bath around the tool and workpiece performs several functions. As a dielectric, it supports the current and voltage to assure a high build-up of energy for each discharge. The fluid and the impurities in it supply ions for the path of the arc. The heat of the spark instantaneously vaporizes and decomposes the fluid in its path. The fluid inertia resists rapid expansion and causes high pressure in the discharge column that intensifies the arc, where temperature are reported in ten thousands of degrees (8000^0-20000^0 C), and expels the molten metal. The dielectric then flushes away the fragments and cools the tool and workpiece. For proper flushing of the debris a numerous flow of fluid is desirable. A common practice is to immerse the tool and workpiece in a bath and pump fluid through holes in the electrode. Light mineral oils, such as kerosene or lubricating oil are satisfactory fluids for most cases. For particular applications, additives or water compounds have been found helpful. Some impurities are desirable, but filtering is necessary to prevent too much contamination.

Zinc-tin, copper, and tungsten alloys, cemented carbides, aluminium, steel, graphite and sometimes other materials are used for electrodes to suit various conditions. One may perform better than others with a certain work material. Electrodes may be machined in