Abstract

The Electrical Discharge Machining (EDM) process was developed to produce cavities in hard metals which were difficult to machine conventionally. The object of this research was to develop techniques to improve the efficiency of the process. An investigation of the relationship between input and output parameters was conducted and from this investigation, it was found that a black layer was formed on the tool surface, which was made up of materials which migrated from the workpiece and the dielectric, appeared to be associated with tool wear ratio (TWR) reduction. The black layer was characterised and a number of empirical relationships were developed relating the migrated materials and TWR. These relationships showed that carbon is the most important black layer material in TWR reduction. The transitory stage of the EDM process was identified as the more important to reduce the TWR. The EDM settings that are source of the variation of the amount of carbon on the surface of the tool were identified. A new technique was used to demonstrate the TWR reduction caused by carbon effect. A coating of carbon is applied to the surface by using input EDM setting; the input settings are then altered to give a high Material Removal Rate (MRR), and the combination of these settings with the carbon layer on the tool gives improved performance compared with the use of a single set of EDM settings. A better understanding of the EDM process control has now been achieved and a new EDM two-stage process has been developed.