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# Effect of process parameters on machining of Al -TiC metal matrix composites using RSM

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## ABSTRACT

The utilization of aluminium and its alloys are widely used in many engineering applications because of its good mechanical properties. But it has to be further improved for its tribological properties by adding hard reinforcement like TiC. At the same while, the manufacturing and machining of this hard aluminium metal matrix composite were complex. To overcome this, the modern method like Electrical Discharge Machine (EDM) was used mostly. However, theoretically or experimentally there is not enough data to machine it at optimal parameter. These were made to focus to evaluate and optimize the EDM process parameters for working to Al-TiC using copper hollow tube electrode. To analyze the wear ratio between tool and workpiece, the experiments are done and the results are statistically analyze during Response Surface Methodology (RSM). The process parameters considered for analysis are Discharge Current, Pulse on Time and Flushing pressure. Finally, the optimum levels of these parameters are determined. © 2020 Elsevier Ltd. All rights reserved.

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## 1. Introduction

The Metal-Matrix Composites (MMCs) are a diverse class of materials that consist of a metallic alloy matrix typically reinforced with a ceramic phase in the form of particles, platelets, whiskers, short fibers, and continuously aligned fibers. Metal-matrix composites are used in structural applications, and in applications requiring wear resistance, thermal management, and weight savings. By far the most common commercial MMCs are based on aluminium, magnesium, and titanium alloys reinforced with silicon carbide (SiC), alumina (Al<sub>2</sub>O<sub>3</sub>), carbon, or graphite. Both continuously and discontinuously reinforced MMCs are used in structural applications. The inclusion of hard ceramic reinforcement exhibits superior wear resistant and destructive to cutting tool. Several factors and process parameters have been used find the optimum parameter of machinability studies on metal matrix composites. Among them RSM plays a significant role to determine best combinations of machining parameters. In this technique it is used to search out the best possible solution between the factors with most interactive manner. From the experimental investigation, it

was found that the results support the signal to noise ratio supports the determination of the finest process design, which is used effectively analyze the composites materials wear behaviour [1,2].

In this work, the “smaller the best” quality characteristics were taken to find the wear ratio between TWR to MRR under various EDM process parameters.

## 2. Experimental methodology

The metal matrix composite of aluminium alloy Al 6061 is the one of the most used material in the manufacturing industries, because of its strength. Al 6061 is the chemical composition of Aluminium 96.5 percentage of weight, ferrous 0.7 percentage of weight, silica 0.6 percentage of weight, Chrome 0.375 percentage of weight, copper 0.275 percentage of weight, zinc 0.25 percentage of weight, Manganese 0.15 percentage of weight, Titanium 0.15 percentage of weight, and Magnesium 0.01 percentage of weight. The Al 6061 is kept into the crucible of the resistant heat furnace and the 600 g weight is casted in every batch of casting. The molar ratio of 1:1.3 is followed to mix the graphite and salt to made composite and the 900 °C temperature is maintained during stirring process [3]. The stirring process takes place in the proper interval

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