



# **iJRASET**

International Journal For Research in  
Applied Science and Engineering Technology



---

# **INTERNATIONAL JOURNAL FOR RESEARCH**

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

---

**Volume: 11      Issue: III      Month of publication: March 2023**

**DOI: <https://doi.org/10.22214/ijraset.2023.49887>**

**[www.ijraset.com](http://www.ijraset.com)**

**Call:  08813907089**

**E-mail ID: [ijraset@gmail.com](mailto:ijraset@gmail.com)**

# Effects of Electrode Heating in Electro chemical Micro Machining

Manigandan N<sup>1</sup>, Lokeshwaran P<sup>2</sup>, Madhan P<sup>3</sup>, Manikandan R<sup>4</sup>, Mouli Prasad C<sup>5</sup>

<sup>1</sup>Assistant Professor, Department of Mechanical Engineering, Paavai Engineering College, Namakkal, India

<sup>2, 3, 4, 5</sup>UG Student, Department of Mechanical Engineering, Paavai Engineering College, Namakkal, India

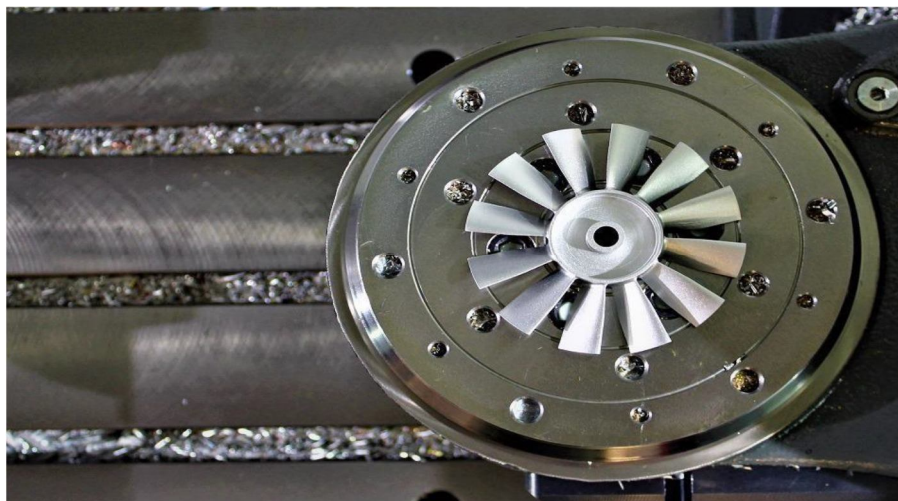
**Abstract:** Composite materials are widely used in various applications and extensive research has been performed to better understanding of mechanical behavior of such materials for taking maximum advantage of their properties. Composite materials have played an important role in particular, aluminium composite offer many benefits i.e., the key among them are corrosion resistance, design flexibility, durability, light weight, and higher strength. Some of the applications of composite such as automotive, aerospace, defence etc.in this project work, aluminium 6061 used as matrix material and cerium oxide acts as a reinforcement.AI composites are fabricated by the stir casting method. In addition, machinability study of AI composites through electrochemical micromachining process.in this machining process, input voltage, duty cycle, electrolyte concentration and % of different reinforcement samples are considered as input parameters whereas, material removal rate, radial over cut are considered as response parameters. Effects of these parameters are studied and reported in future.

## I. INTRODUCTION

Composite materials are widely used in various applications, and extensive research has been performed to better understanding of mechanical behavior of such materials for taking maximum advantage of their properties. Commonly used metallic matrices include Al, Mg, Ti and their alloys. Generally, alloys are the preferred matrix materials for MMCs, due to possibilities to additional strengthening effects and flexible property design. For MMCs, fibres, whiskers, and particulates are commonly used as reinforcements. Composite materials have played an important role in particular, Aluminum composites offer many benefits i.e., the key among them are corrosion resistance, design flexibility, durability, light weight, and higher strength. Some of the applications of composite such as rocket ships, aerospace, Automotive, medical applications, etc.

### A. Aluminium 6061

Aluminium 6061 alloy is low wear resistance compare to other Aluminium series and it contains more composite materials of magnesium and silicon components. It plays a major role for hardening and strengthening the materials. It is commonly available in pre-tempered grades such as 6061-O(annealed), tempered grades such as 6061-T6 (solution zed and artificially aged) and 6061-T651 (solution zed , stress relieved structured and artificially aged).



### B. Stir Casting

Stir casting is a suitable processing technique to fabricate aluminium matrix composites and hybrid aluminium matrix composites as it is an economical process and preferred for mass production. The first step of stir casting involves melting of aluminium.

During melting, aluminium melt reacts with the atmosphere and moisture and forms a layer of aluminium oxide ( $Al_2O_3$ ). Stir casting is a type of casting process in which a mechanical stirrer is introduced to form vortex to mix reinforcement in the matrix material. It is a suitable process for production of metal matrix composites due to its cost effectiveness, applicability to mass production, simplicity, almost net shaping and easier control of composite structure. Its advantages lie in its simplicity, flexibility and applicability to large quantity production with cost advantage.

### C. Radial Over Cut

Radial over cut increases with increase in voltage. The increase in the voltage leads to greater electrolyzing current in the Inter Electrode Gap and greater stray current intensity, which causes to higher ROC. Radial over cut decreases with increase in feed rate, due to the operation stability at higher feed rates and reduces the removal of material in lateral direction of the hole.

Greater volume of reaction products, e.g. sludge's and precipitations are formed at higher electrolyte concentration and leads to the initiation of gas bubbles, e.g.  $O_2$ ,  $H_2$ , etc. These effects leads to the possibility of the passage of stray current to the machining periphery thereby increase the ROC. The minimum radial over cut was achieved at lowest voltage and highest feed rate combination. From it is observed that radial over cut increases with increasing voltage and electrolyte concentration. The controlled over cut was achieved at the lowest voltage and lowest electrolyte concentration combination.

### D. Selection Of Radial Overcut

The radial overcut is the deviation between the dimension of the electrode and the size of the cavity produced during ECMM. To achieve the accuracy, overcut is required. Therefore it is mandatory to determine the influence of the factors on overcut.

### E. Electro Chemical Micro Machining

In electrochemical micromachining metal removal takes place with an electrolyte between workpiece and tool, which are connected as anode and cathode. When an electric current is passed through the electrolyte the workpiece is selectively dissolved and becomes a replica of the shape of the tool. Reaction products and heat are carried away by rapid electrolyte flow through the gap.

An elaborate system is necessary for the circulation and purification of the electrolyte and also for adjusting the machining voltage, for tool feed and for protecting the system from short-circuiting. The metal-removal rate and accuracy of form depend on tooling, electrolyte, gap width, current density and electrolyte flow rate. In the ECMM method the mechanical properties of the workpiece material play no part. As compared with other machining methods with no direct contact between tool and workpiece, such as spark machining (electro-discharge machining, EDM) as described earlier. ECMM has the advantage that metal can be removed very rapidly.

## II. CONCLUSION

From the review process described above, it was shown that many researchers have successfully demonstrated the use of Electro Chemical Micro Machining. Among them, we have selected some of their ideas for the testing of the composite.

We selected ECMM for testing of the material, because it produces high surface quality of the material and the accuracy of the machining operation is high. As we mentioned above, the using of aluminium composite is for its lightweight and flexibility during machining. For that, we collected materials for the research and the final result of the testing in the Chemical Machine will be established shortly.

## REFERENCES

- [1] S Saravanan, Av Balan, S Dinesh, V Vijayan - Materials Today, 2020 "Machining Of Aluminum Metal Matrix Composites Were Investigated"
- [2] R Shanmugam, M Ramoni, G Thangamani - Metals, 2021 "Additive Manufacturing Technology Provides A Gateway To Completely New Horizons"
- [3] M Wu, J Liu, J He, X Chen, Z Guo - International Journal Of Machine Tools, 2020. "Electrochemical Processing Technique"
- [4] A Thakur, M Tak, Rg Mote - Procedia Manufacturing, 2019 "The Efficiency Of Engineering Components Like Aerospace, Biomedical, Tribology, Defense"
- [5] N Krishnan, J Deepak, P Hariharan - Engineering Research, 2020-Materials Processing Technology, "To Generate Grooves In Difficult-To-Machine Materials"
- [6] S Skoczypiec, P Lipiec, W Bizoń, D Wyszynski - Materials, 2021. "Selected Aspects Of Electrochemical Micromachining Technology Development"
- [7] S.Ajith Arul Danielb ,A.Parthibanb ,T.Vinod Kumar, "Investigation On The Response Parameters In Electric Discharge Machining Of Developed Aluminum Metal Matrix Composites"



- [8] J.W.Liua , T.M.Yuea , Z.N.Guob, "An Analysis Of The Discharge Mechanism In Electrochemical Discharge Machining Of Particulate Reinforced Metal Matrix Composites"
- [9] Rajeshkumar, G., A. M. Harikrishna, And S. Ajithkumar. "A Comprehensive Review On Manufacturing Methods And Characterization Of Al6061 Composites." *Materials Today*" (2020)
- [10] Prathipa, R., C. Sivakumar, And B. Shanmugasundaram. "Experimental Investigation Of Aluminium (Al6061) Alloy With Fly Ash Metal Matrix Composite Material." *Annals Of The Romanian Society For Cell Biology* (2021).



10.22214/IJRASET



45.98



IMPACT FACTOR:  
7.129



IMPACT FACTOR:  
7.429



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24\*7 Support on Whatsapp)