A REVIEW ON THE EFFECT OF MAGNETIC FIELD IN ECM PROCESS

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Abstract: This paper mainly discusses the effect of magnetic field in ECM process done by various authors. The magneto hydrodynamic effect due to magnetic field on electrolyte is justified. The performance characteristics due to MHD effect are discussed. From this paper, one can infer the knowledge of how to improve the performance characteristics of ECM while applying the magnetic field.

IndexTerms **–Machining, ECM, Magnetic field, MHD**

I. INTRODUCTION

Electrochemical machining (ECM) is an advanced machining process. In other words it is reverse of electro-plating process. The metal removing is done by electrolysis process based on the principle of faradays law of electrolysis [8]. This electro chemical machining, able to cut conductive and very hard & tough materials such as titanium, Inconel, and high nickel, cobalt, and rhenium alloys [9], [10]. This process can be useful to machining both internal and external geometric work materials. This paper discusses about the study of magneto- hydrodynamic effect and its literature in ECM process.

II. LITERATURE SURVEY

Although number of experimental analysis and investigation has done on electrochemical machining using different methodology for different application, still there is a vision in the research to improve the performance characteristics such as surface finish, cutting speed etc. Here our concentration is the study of effect of magnetic field in ECM. Some authors proved that metal deposition is increased due to magneto hydrodynamic effect by applying magnetic field in ECM process. Some of the Literatures are given below.

Fan et al.: The experiment is conducted by varying the intensity and the direction of the magnetic field. The variation of equipotential line is observed, and the magnetic induction is measured by using CT3-A type gauss meter. The result of the experimentation is increase of probability for the reaction particles to be excited to higher energy level from the ground state and the dispersion corrosions are reduced.

Bnud etal.: In this experiment, a magnetic field applied near the machining environment. During the experiments the partial currents for the nucleation of nickel in magnetic fields were determined using an in situ micro-gravimetric technique. The next important focus is the numerical simulation of magneto hydrodynamic effects on electrochemical metal deposition. From this experimentation, it is inferred that the increased mass transport rates is a direct consequence of Lorentz forces in the bulk of the electrolyte. This enhanced mass transport directly affects the electro-crystallization.

Tang etal.: This author explains the response parameter under the effect of magnetic field. The experiment is conducted under the conditions of 12 % of sodium nitrate (NaNO3), voltage - 18 V, electrolyte pressure - 0.8-MPa, temperature - 32 °C, tool feed rate - 0.9 mm/min, machining gap - 0.1 mm. The work material is S-03 special stainless steel. The experiments were done under various conditions of magnetic field, such as: concentrated magnetic field, periodic magnetic field, and no magnetic field. From the experimentation, it is inferred that the precision in the concentrated magnetic field is increased by 33.3 % when compared with no magnetic field circuit and increased by 14.8 % when compared with the periodic magnetic field.

Yul et al.: This author undergoes the analysis of effect magnetic field by changing electrical process parameter. In the experimentation the magnetic fields were applied parallel to electric fields to prepare cobalt thin films from the electrolyte without chemical additives. The Steady state current and deposition mass of cobalt decreased gradually with the increase of intensity of magnetic field. In the analysis of quartz microbalance, deposition mass of cobalt decreased from 95.6 to 69.3 μg with the increase of intensity of magnetic field. Finally the Hill-like structures started to appear with the increased magnetic field.

III. JUSTIFICATION ON THE EFFECT OF MAGNETIC FIELD IN ECM PROCESS

It is justified that the effect which occurs during applying the magnetic field in ECM is magneto hydrodynamic effect [5].

3.1 Magneto hydrodynamic effect:

The fluid dynamic phenomenon of applying voltage in a conductive fluid flowing through a magnetic field is called the magneto hydrodynamic (MHD) effect. Magneto-hydro-dynamic is the study of the magnetic properties of electrically conducting fluids such as plasma, liquid metals, salt water, and electrolytes [6]. The science of MHD is that the magnetic fields will induce currents in a moving conductive fluid, which create forces on the fluid. The result of the MHD effect is Lorentz force in electrolyte [7].

IV. CONCLUSION

The effect of MHD in electrochemical machining process, results in both improved metal deposition and surface finish. From above information it is inferred that the magnetic field assisted ECM will definitely increase the mass transfer rate of work material. It is found that the magneto hydrodynamic effect on electrolyte is obvious when applying magnetic field. However the experimental conditions, input process parameter, strength of magnetic field and the methodology of experimentation which decides the improvement of performance characteristics. So it is very important to consider the method of applying the magnetic field around the machining environment of ECM process.

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