A prospective view of micro electric discharge coating

[1]Lokesh kumar ranjan, [2]Rajnish kumar ranjan, [3]Rashmi ranjan
[1]Guest Faculy, [2]Student, [3]Student
[1]Motihari engineering college,
[2]Punjabi university,
[3]Punjabi university

***Abstract* - Nowadays machining is done through the micro-electric discharge process which is generally applied in the precision machining process. The deposition of material can be done via reversing the polarity in the electric discharge machining process. The negative polarity of tool material is found to be helpful in the deposition of tool material on the work piece surface. This technique is used as a new material deposition method for advance application. Current paper gives an idea of recent trends in micro-electrical discharge coating**

***keywords* - micro, surface, electric discharge, coating, tool**

I. INTRODUCTION

Maintenance and repair are common phenomena and required activity for industrial damage. Due to this activity, billions of rupees get a loss by the industry per year. Various component failures are identified due to the corrosion resistance, fatigue failure, wear and rupture. These kinds of industrial damage are responsible for affecting the gross GDP and economy for the nation and it is observed that 3-4% of GDP is directly affected. This damage can be overcome by applying different coating on the material surface that will enhance the equipment life.

Now a day's large number of coating techniques are available. The famous one is physical, chemical, mechanical and electrochemical process. In automotive and aerospace application coatings of chromium (Cr) is commonly used for improving the properties like wear and hardness, heat and corrosion resistance. There are several methods for obtaining different types of surface coatings, which may be classified as thick coating and thin coating.

Thick coating can be produce on the substrate or surface, such as electro deposition, Thermal/Plasma spraying (0.076 to 0.25mm), laser cladding. Similarly, thin layer type of coatings can be done by some method like physical vapor deposition (0.002 mm to 0.004 mm), chemical vapor deposition (0.002 mm to 0.004 mm), electrochemical deposition, ion plating, electro less plating (0.0005" and up to0.010").

The above techniques have some disadvantages like high initial cost, vacuum, and high-temperature requirement. To overcome this electric discharge coating concept can be used with some process parameters. EDC can be used for the thin and thick material deposition or coating for the requirement. Also, this process has benefits like it does not require the vacuum and high-temperature devices. During coating process, the thickness can be controlled by varying parameters. The MEDC technique widely used in rolling industry, surface alloying of die, molds and cutting tool devices.

II. WORKING PRINCIPLE OF MEDC PROCESS

Micro electric discharge coating very similar to the micro electric discharge machining process. It is just opposite to the electric discharge machining process.in this technique the tool material or dielectric fluid is changed to the required type of coating.in the EDC both work pieces and tools are immersed in dielectric medium and placed near to each other. The negative terminal is connected to the tool while the workpiece as positive terminal of the power source. When the applied voltage goes beyond the threshold voltage the dielectric gets breakdown and spark is produced. This amount of spark is directly depends upon the power supply amount the electrode material and dielectric fluid.

During the micro electric discharge coating the transfer of coating material takes place in the passage of two electrode.by the selecting the proper parameters setting. During the sparking, the tool erodes at higher speed as compared to the workpiece. The erosion of the tool material forms a chemical bonding to the workpiece due to the chemical reaction between the dielectric fluid, tool, and work material

III. MICRO ELECTRIC DISCHARGE COATING (MEDC)

EDM can cut material of any hardness is used for deposition or alloying processes. Thus, due to the small nature of components, and their increasing demand in manufacturing industries, µ-EDM is used to develop the desired layer on the work material to study the performance and features of the same.

In this aspects dielectric with powder mixed in EDM/µEDM is one of the methods to further development of alloys surface or coated surface and hence surface properties are improved.

IV. REQUIREMENT FOR MEDC

For micro-electric discharge coating, the main requirement is a micro-electric discharge process setup, tool material for required kind of deposition, work surface or substrate.

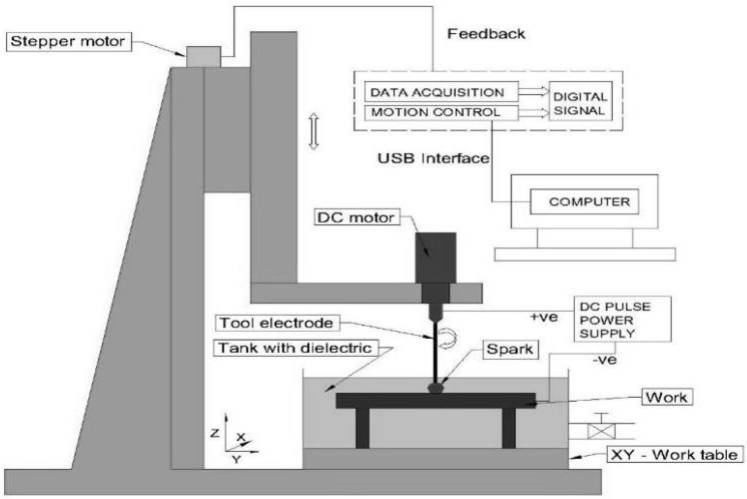

Fig 1.1 Schematic of micro-EDM set-up[1]

V. RESPONSIBLE PARAMETERS FOR μ EDC

The responsible parameters include both parameters like input and output. Input parameters include powder concentration (gram/liter), peak (max) current, duty factor and working voltage (V) whereas output parameters include material removal rate, surface roughness, and micro hardness.

Amount of Material removal rate; the material removal rate is calculated by weight-loss method, surface roughness measured by surface roughness tester and microhardness test measured by Vickers hardness test equipment.

The material removal rate is measured by formula as MRR = $[Wf - Wi]/t$ (g/min) where W_f is final weight W_i is initial weight amount of work piece and t is the time for machining.

ADVANTAGES OF MEDC

There are direct benefits by applying MEDC, which include direct adhesion between the work material and the coated layer, thick layer deposition capability and also provide for multiple materials coating having different melting temperature.

DISADVANTAGES OF MEDC

The main disadvantages include micro level setup cost and advanced skills requirement. Also knowledge of material and surface morphology is required for doing MEDC.

APPLICATION OF MEDC

Micro-level coating or surface modification at micro level has been now commonly used in the area of biomedical engineering, specifically in dental and orthopedic applications, on receiving body tissues to enhance the biomechanical and morphological compatibilities between the present and new receiving body tissues.

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