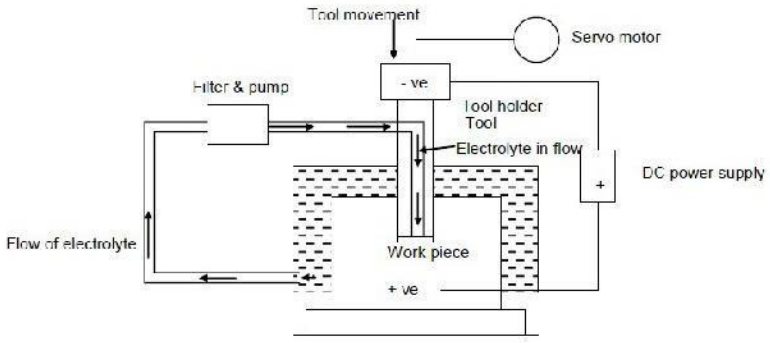

Fig : Electro chemical Machining

Tool

A specially designed and shaped tool is used for ECM, which forms cathode in the ECM setup. The tool is usually made of copper, brass, stainless steel, and it is a mirror image of the desired machined cavity. Proper allowances are given in the tool size to get the dimensional accuracy of the machined surface.

SURFACE ROUGHNESS AND MRR :

The material removal rate by ECM is given by:

$$MRR \quad C\,I$$

where,

MRR=mm3/min,

I=current in amperes,

□=current efficiency, which typically ranges from 90-100%,

C is a material constant in mm3/A·min.

ELECTRICAL CIRCUIT :

Power Supply

DC power source should be used to supply the current. Tool is connected with the negative terminal and workpiece with the positive terminal of the power source. Power supply supplies low voltage (3 to 4 volts) and high current to the circuit.

Electrolyte

Water is used as base of electrolyte in ECM. Normally water soluble NaCl and NaNO3 are used as electrolyte. Electrolyte facilitates are carrier of dissolved workpiece material. It is recycled by a pump after filtration.

Tool Feed Mechanism

Servo motor is used to feed the tool to the machining zone. It is necessary to maintain a constant gap between the workpiece and tool so tool feed rate is kept accordingly while machining. In addition to the above whole process is carried out in a tank filled with electrolyte. The tank is made of transparent plastic which should be non-reactive to the electrolyte. Connecting wires are required to connect electrodes to the power supply.

PROCESS PARAMETERS :

- Feed rate (mm/min): $f \square\square MRR / A$

Assuming a cavity with uniform cross-sectional area A0

ECG and ECH :

Electrochemical Grinding, or ECG, is a variation of ECM (Electrochemical Machining) that combines electrolytic activity with the physical removal of material by means of charged grinding wheels. Electrochemical Grinding (ECG) can produce burr free and stress free parts without heat or other metallurgical damage caused by mechanical grinding, eliminating the need for secondary machining operations. Like ECM, Electrochemical Grinding (ECG) generates little or no heat that can distort delicate components. Electrochemical Grinding (ECG) can process any conductive material that is electrochemically reactive. The most common reason customers choose.

Electro Chemical Grinding :

(ECG) is for the burr free quality of the cut. If a part is difficult or costly to deburr, then ELECTROCHEMICAL GRINDING (ECG) is the best option. Materials that are

difficult to machine by conventional methods, that work harden easily or are subject to heat damage are also good candidates for the stress free and no heat characteristics of ELECTROCHEMICAL GRINDING (ECG). The stress free cutting capability of the process also make it ideal for thin wall and delicate parts.The real value of Electrochemical Grinding (ECG) is in metalworking applications that are too difficult or time-consuming for traditional mechanical methods (milling, turning, grinding,deburring etc.). It is also effective when compared to non-traditional machining processes such as wire and sinker EDM. ELECTROCHEMICAL GRINDING (ECG) is almost always more cost effective than EDM.

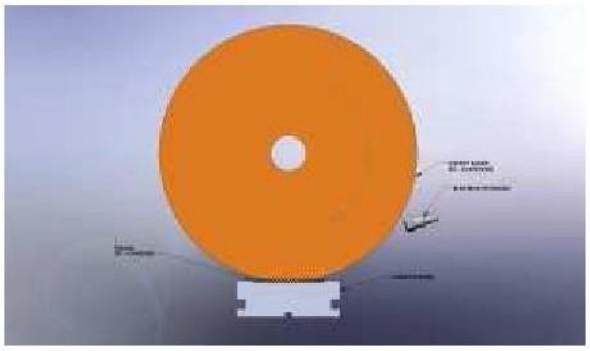

Fig : Electro Chemical Grinding

Conventional surface grinding typically uses shallow reciprocating cuts that sweep across the work surface to create a flat plane or groove. Another conventional surface grinding process, creep feed grinding, typically uses slower feeds than conventional surface grinding and removes material in deep cuts. Because of the abrasive nature of these processes, the equipment used must be rigid and this is especially true of creep feed grinding.

Quality ELECTROCHEMICAL GRINDING (ECG) machines must also be rigid for close tolerance results but since very little of the material removed is done so abrasively the machines do not have to be as massive as their conventional counterparts. To a user familiar

with creep feed grinding ELECTROCHEMICAL GRINDING (ECG) will appear to be very similar, that is, relatively slow feeds (as compared to conventional surface grinding) and deep

cuts as opposed to shallow reciprocating cuts. ELECTROCHEMICAL GRINDING (ECG) is a combination of electrochemical (Anodic) dissolution of a material, according to Faraday's Law, and light abrasive action. The metal is decomposed to some degree by the DC current flow between the conductive grinding wheel (Cathode) and the work piece (Anode) in the presence of an electrolyte solution. Unlike conventional grinding techniques, ELECTROCHEMICAL GRINDING (ECG) offers the ability to machine difficult materials independent of their hardness or strength. ELECTROCHEMICAL

GRINDING (ECG) does not rely solely on an abrasive process; the results are precise burr free and stress free cuts with no heat and mechanical distortions.

Electro Chemical Honing :

Electrochemical honing is one of the non-equilibrium gap processes in ECM and is a new technique, which in spite of being used in some industrial plants especially to smooth surfaces, is still not fully described due to the variety of the factors affecting the process. More information about the process is required especially the effects of the working parameters on the produced surface roughness. A special honing tool was designed by using different tool tip shapes (rectangular, circular, triangle & inclined) to study the ability for improving the surface roughness. This work presents a study for the factors affecting the electrochemical honing process especially the machining time, workpiece material, initial working gap, tool rotational speed, tool tip shape and the inclined tool tip angle. The results are finally furnished with the aim to generalize a useful guideline for the user to enable proper selection of conditions for obtaining good surface quality.

APPLICATIONS :

- *Electrochemical Grinding* : This can also be named as electro chemical debrruing. This is used for anodic dissolution of burrs or roughness a surface to make it smooth. Any conducting material can be machined by this process. The quality of finish largely depends on the quality of finish of the tool.
- This is applied in internal finishing of surgical needles and also for their sharpening.
- Machining of hard, brittle, heat resistant materials without any problem.
- Drilling of small and deeper holes with very good quality of internal surface finish.
- Machining of cavities and holes of complicated and irregular shapes.
- It is used for making inclined and blind holes and finishing of conventionally machined surfaces.