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Working of Electrochemical Grinding and Honing

Amarnath N A S*, Akash S*, Anand ShankarM*, Akshay Kumar*, Roopa D N**

[*] *Students,* [**]*Assistant ProfessorDepartment of Mechanical Engineering JSS Academy of Technical Education, Bangalore- 560060, India*
Corresponding Author: Amarnath N A S

ABSTRACT
This paper presents the presents the working and process parameters of Electro Chemical Grinding and Honing Process. The main aim of the work is to find the optimum values of machining parameters. The Non-Traditional or Unconventional Machining Process has proved to be better than conventional machining process to a large extent.

Key Words: Non-Traditional Machining, Electrochemical Grinding, Electrochemical Honing

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I. INTRODUCTION TO ELECTRO CHEMICAL GRINDING

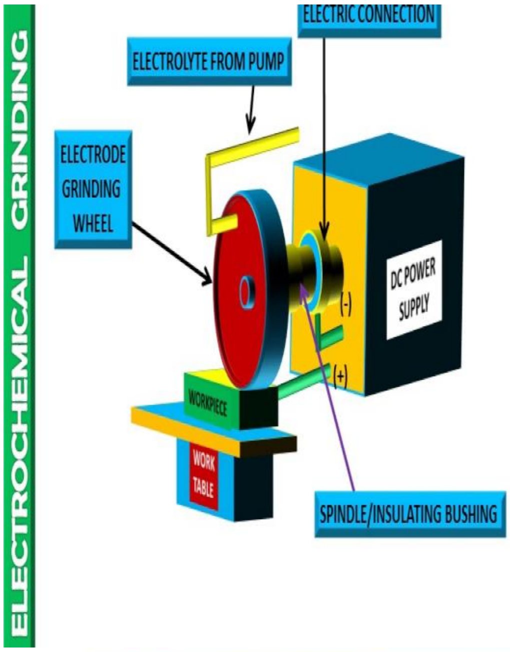
Electrochemical grinding (ECG) is a hybridised process that is a combinationof electrochemical machining (ECM) and mechanical grinding processes. TheECG process is applicable for shaping or grinding an electrically conductivematerial.Used primarily to machine difficult to cut alloys such as stainless steel, Hastelloy, Inconel, Monel, Waspally and tungsten carbide, heat treated workpeices, fragile or therm-sensitive parts, or parts for which stress-free and burr-free results are required. Process introduced in the early 1950s evolving from developments in the USSR on EDM. ECG removes metal by a combination of electrochemical and grinding actions.

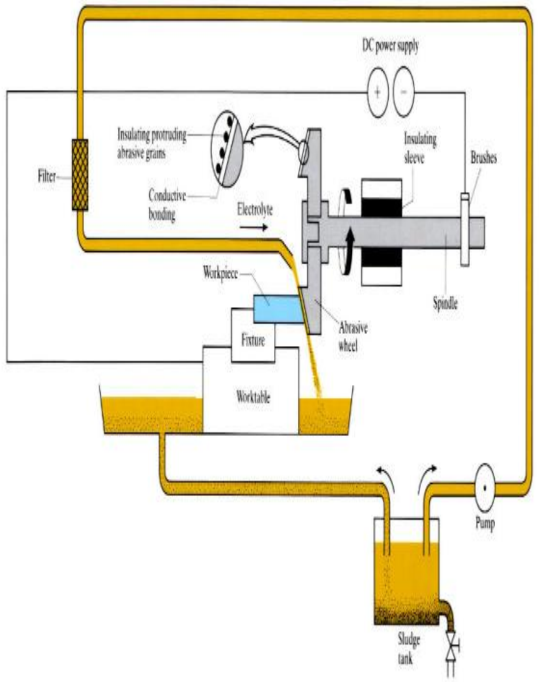
In mechanical grinding, the ground surface consists of micro-burrsand lays. The addition of electrochemical (EC) anodic dissolution, in whichmetal is removed from the anode in clusters of atoms/molecules, producesburr- and lay-free surfaces during ECG. Heat generation during this process ismuch less as compared to mechanical grinding because a major part of mate-rial removal takes place due to electrolytic anodic dissolution. Thus, no thermal residual stresses and heat-affected zone are obtained during the ECG process.

The process requires an abrasive-laden grinding wheel, which is bonded withan electrically conductive material. The grinding wheel is connected to thenegative terminal (cathode) and the workpiece to the positive terminal (anode)of a DC power source. The tool and workpiece are separated by a gap of fewhundred micrometres. In this gap, electrolyte is supplied through a jet, whichis recycled after removing debris and reaction products (chips and precipitatesformed during EC dissolution) through alter. Redox reactions take placebetween the tool and workpiece, and simultaneously, active abrasive particles inthe machining zone start removing metal from the workpiece through erosion.

In general, only 5%–10% material removal takes place by mechanical action,while EC dissolution is responsible for 90%–95% of the material removal. Less power is needed for ECG than for ECM since the machining area is smaller and the abrasive in the wheel is removing the oxide film – current ranges from 5 to 1000A are most common, with a voltage of 3 to 15V over an electrolyte gap of approximately 0.25mm or less and wheel speeds of 1100 to 1800m/min. Many similarities between ECG and conventional grinding make this one of the easiest ECM based processes to both understand and implement – grinding wheel closely resemble their conventional counterparts with the exception that ECG wheels use an electrically conductive abrasive bonding agent; electrolyte is introduced to the work area in the same manner that coolant is introduced in conventional grinding.

The recent trend shows that advanced material's processing has becomea challenge to the industries because of outstanding mechanical propertiesof materials such as high strength-to-weight ratios, high melting point, highductility, etc. Industries are also facing challenges in fulfilling the desired, accuracy and surface integrity of the products in the present day'scustomer-driven market.





Major components of the system:

- Electrolyte delivery and circulating system
- Electrolyte
- DC power supply
- Grinding wheel
- Work piece

Electrolyte delivery and circulating system:

- The electrodes are not totally immersed, yet there must be an ample supply of electrolyte
- Nozzles are used to ensure proper wetting action of the wheel
- Nozzle creates a partial vacuum and causes the electrolyte to be sucked up, filling the cavities around the grit – the rotation of the wheel then carries the electrolyte into the area of contact between the workpiece and the wheel.

Power Supply for ECG:

An ECG machine can operate on continuous DC or pulsed DC power supply.

Both have their own merits and demerits.

- **Continuous DC power :**EC machining operation is fast enough when continuous DC power supply is employed since the amount of mat erialremovaldepends upon the magnitude of current flowing between the cathode and anode.
- **Pulsed DC power:** P-ECG supply provides pulsating energy flux because the current is supplied in small segments at the desired frequency. This implies proper execution of EC dissolution by providing a pulse-off time and comparatively low MRR. When the pulse is off, sludge produced due to EC reactions is pushed out from the machining zone. The pulsed EC process enhances surface integrity. In pulsed EC finishing, the surface roughness value can be reduced from 3 μm to 1.22 μm. It has been observed that P-ECG supply in ECG is an appropriate means for enhancing control over the process variables and repeatability. In addition, P-ECG reduces overcutsignificantly.

Grinding Wheel:

ECG wheels are manufactured by using copper, brass, nickel, or copper impregnated resin as a bonding material. To dress these metal bonded wheels,electrochemical anodic dissolution is performed (by making the wheel as anode and a scrap metal as cathode). Metal is removed from the ECG wheeland abrasive particles are projected to work as cutting tools. During the electrochemical dressing of the wheels, wheel trueing is also done automatically. In the ECG process, material removal mainly takes place due to EC dissolution; hence, dressing of metal bonded wheel is not required frequently.

Manufacturing of the wheel used in ECG is an essential task because the main purpose of the abrasive particles is to maintain a uniform gap between the electrically conducting wheel and the workpiece throughout the rotation. In addition, secondary material removal by the abrasive particles takes place by removing the oxide layer formed during electrolysis and material removal from the workpiece in general. Metal (bronze) bonded diamond composite wheels are used to grind electrically conductive ceramics.

The abrasive grains on the ECG wheel serve three major purposes:

- Act to wipe the oxide from the work piece, exposing new metal and allowing the process to continue.
- Spacer to keep the conductive media in the wheel from making direct contact with the work piece and generating a short circuit.
- The cavities between the grit are filled with electrolyte, and the grit acts as a carrier bringing the electrolyte to the work area between the workpiece and the wheel making the ECG process possible.

Electrolytes:

Sodium chloride is an efficient electrolyte for grinding ferrous, nickel and cobalt alloys. But in some specific cases, NaCl is not recommended since it ishighly aggressive towards anodic dissolution as well as corrosion. The problems of rust and tolerance control have more concern when NaCl is used as an electrolyte. $NaNO_3$ (Sodium nitrate) is therefore employed to many alloys and tungsten carbide. Additives are added to $NaNO_3$ such as rust inhibitor and chelating agent (which forms bond with single metal ion).

Work piece material

1. Almost any conducting material, irrespective of hardness, but best suited to hard materials (>400Hv) and the difficult-to-machine materials such as zirconium and beryllium.
2. Dissimilar combinations of materials can be ground as long as they are electrically conductive.
3. Due to the low machine forces (0.5–1 MPa) the material is stress free and with the minimum of distortion.
4. Unlike conventional grinding there is no work hardening of the surface of the material.
5. Poor operating conditions can lead to hydrogen pick-up in steels.

Working of electrochemical grinding:

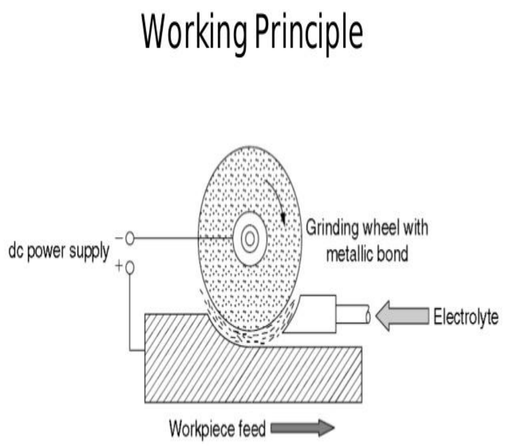
The tool is replaced by electrically conductive grinding wheel. The grinding wheel is rotated as well as fed in the desired direction for facing or grinding operation. The feed of the wheel is constrained by the rate of material removal due to electro chemical reaction and due to mechanical abrasion to maintain a minimum inter-electrode gap so that short-circuiting can be avoided. When electro chemical anodic dissolution starts, an oxide layer is formed (while using a certain type of electrolyte) on the workpiece surface, which works as an insulator. This oxide layer is removed by forcing the electrolyte between the tool and workpiece with a high velocity.

The machining area is categorised into three zones (zone I, zone II and zone III). In zone I, material removal takes place due to pure EC anodic dissolution. The inter electrode gap keeps on varying along the electrolyte flow direction. Rotation of the wheel enhances the circulation and drawing of the electrolyte through the narrow machining gap. As electro chemical reactions in zone I occur, reaction products such as gases, precipitates, oxide layer, etc., mix in the electrolyte and change its conductivity. In fact, the presence of sludge, which is normally electrically conductive and temperature gradient, to some extent, increases the conductivity of the electrolyte. But the presence of gases generated and contaminated precipitates decrease the conductivity, which generally lead to the decreased value of net conductivity of the electrolyte.

The rotational speed of the ECG wheel and electrolyte jet velocity force this electrolyte into zone II. The electrolyte conductivity reduces in zone IIand the inter electrode gap(IEG) becomes smaller than in zone I. Further, if the IEG is smaller than the protrusion height of the abrasive particles, then removal of a smallamount of the workpiece material by erosion takes place. As a result of the reduction in the IEG, the volume of gases in the gap is reduced due to compression; hence, material removal rate (MRR) due to anodic dissolution isincreased. The abrasive particles of the grinding wheel remove the nonreactive (oxide) layer if generated due to EC reactions. Most of the metal oxides formed during EC reactions are insoluble in water and electrically non-conductive. The formation of this layer acts as an insulator and becomes an obstacle in anodic dissolution. Hence, removal of the oxide layer is an essential step in the ECG process. Thus, in zone II, material removaltakes place due to mechanical action in the form of removal of the passivation layer and workpiece material in the form of micro/nano-chips or in the form of metal ions that react in the electrolyte and form reaction products. However, at the same time, material removal takes place due to EC anodic dissolution also.

In zone III, metal removal takes place solely through EC dissolution becausethe abrasive particles are disengaged from the work surface. Electrolyte pres-sure is released in this zone; hence, bubble formation reduces the electrolyteconductivity. As a result, EC anodic dissolution rate decreases. However,the current density at the discontinuity is much higher than at other points; hence, the scratches and burrs produced in zone II dissolve.In ECG, metal removal depends on the gap between the wheel and work-piece. The gap between the two electrodes influences the amount of electrolyte and current carrying capacity. When grinding force is low, metal removal is due to EC dissolution only. In general, aqueous solution of saltsor bases is used as an electrolyte in ECG. EC dissolution in the presence of such electrolytes results a passive layer on the anode surface. This layerincreases resistance to the low of current between the wheel and workpiece;hence, material removal due to EC reactions decreases. As the wheel is fedtowards the workpiece, the gap becomes smaller, which leads to an increasein grinding force. As grinding force is higher, abrasives remove the passivelayer by erosion process from the workpiece; hence, it allows the EC processes to take place on the fresh workpiece surface. The existenceof these two material removal processes increases net material removalby a significant amount

However, material removed by EC dissolution varies on increasing the grinding force and attains an optimum value. Hence, the combined effect of both mechanisms results in the highest MRR.ECG can be performed in internal as well as external surfaces. It can be used for formed surface, flat surface, or the face of the cylindrical surface.



Variants of ECG

The ECG operation can be performed in several ways to achieve the requiredmaterial removal from the workpiece. The wheel of an ECG machine can be replaced by a belt or some other type of tool on the basis of the desired applications. Some variants of ECG in practice are as follows:

1. Belt-type ECG

The process grinds/machines flat and cylindrical work pieces using an electrically conductive flexible belt laden with abrasive particles. The belt is tightened on a couple of pulleys placed at a certain distance. The assembly of the system is made in such a way that the work piece always remains in contact with the composite belt at a point where the pulley provides backing to the belt [9,10]. A schematic diagram of the belt type of ECG. The electrolyte is supplied in between the abrasive-particles-laden belt and the work piece throughout the machining zone with the help of centrifugal force. The process of belt-type ECG is well accepted in commercial applications because MRR is higher as compared to the conventional ECG In addition, the process provides uniform ground surface with good surface finish.

2. EC cut-off grinding

This machine works on the principle of ECG, which can cut offcomposite materials consisting of metals and non-metals. The process requires lesser cutting force than the conventional machining processes and results in a low surface roughness value due to the effect of EC dissolution.

3. ECG boring

This type of machining setup can enlarge microhole on difficult-to-machine materials of about 500 μm diameter depending upon the tool accuracy In ECG boring, a metal rod with spherical end coated with diamond abrasive particles is used as an ECG tool to enlarge a hole of D_0 to (D_0 + ΔD) diameter.In this process, the material removal occurs in two zones, and insome cases, in three zones:Zone 1—Material is removed totally by EC dissolution. Due to EC reactions, a passivation layer is formed on the inner surface ofthe hole if a passive electrolyte (NaNO).

Zone 2—Metal is removed through mechanical erosion and EC dissolution both. Due to the feed given to the tool inside the hole, the gap between abrasive particles and wall of the hole decreases, non-reactive passivation layer (if formed), and workpiece material are removed by abrasion. Further, a small amount of thematerial is removed by EC anodic dissolution in the micro/nanoelectrolytic cell formed between the ECGB tool bonding material and workpiece.

Zone 3—No material removal takes place since half of the surface area of the spherical end of the tool is insulated. This implies that there is no electric current flow between the workpiece and the tool in this zone. If the tool is not insulated, EC dissolution takes place and material removal starts in zone 3 also.

Process parameters of electro chemical grinding:

- ECG exhibits MRRs that are up to 10 times faster than conventional grinding on materials harder than 60HRC; although MRRs are high, ECG cannot obtain the tolerances achieved by conventional grinding
- The removal rate for ECG is governed by the current density, just as in ECM: as with ECM, the higher the current density, the faster the removal rate and the better the resulting surface finish
- Feed rates vary with different parameters, depending on the grinding method: if the feed rate is running too slowly for the application, a large overcut will be produced that will result in poor surface finishes and tolerances and if the feed rate is too fast, the abrasive particles will be prematurely forced into the workpiece, resulting in excessive wheel wear

Advantages of electro chemical grinding:

- Conventional grinding process requires a post-process for deburring the machined surface, but ECG provides a burr-free machinedsurface.
- ECG results in a stress-free ground surface; hence, small and delicateproducts can be ground effectively.
- Hard-to-grind materials ca n be comparatively easily ground throughthe ECG process, since MRR is independent of the hardness and temper of metals. ECG is moreover a “cold” process as the temperatureat the wheel–work piece interface does not rise beyond 100°C .
- In the grinding process, the required intense specific cutting energyleads to very high temperature rise. EC ground parts are without metallurgical damage (such as work hardening, structural change,micro-cracks, etc.) and without any change in mechanical properties(hardness) because comparatively very less heat is generated duringthe ECG process.
- The life of grinding wheel is higher as compared to conventionalgrinding wheel; hence, the cost of production is lower. Further, frequent wheel dressing is not required since wheel loading and glazing are rare in ECG

Limitations of electro chemical grinding

- A material that is electrochemically reactive can only be ground byECG.
- ECG performs effectively only when the workpiece is electricallyconductive.
- Generated overcut due to un-controlled ECM by the side face of thewheel limits the ECG process; hence, the accuracy is affected [25].
- Maintaining least IEG for ECG to happen requires very precise control during the feed.

App lications of electrochemical grinding:

The ECG process is suitable for grinding exotic alloys, carbides and otherhard-to-machine materials. ECG is generally employed in space and nuclearindustries for special purposes, such as grinding of heat- and stress-sensitivematerials, form grinding, face or peripheral grinding, etc. Metals suchas steels, Haste alloy, aluminium (Al), copper (Cu) and Inconel alloys can beeffectively machined by ECG. Machining of other materials such as nickel/titanium, cobalt alloys, Rene 41, rhenium, rhodium, stelllite, vitalium, zirco-nium and tungsten is also possible.

CONCLUSION:

Development of an ECH set-up is reported. ECH can be thought of as an interaction process of controlled electrolytic dissolution and selective mechanical abrading, the efficiency of which in correcting micro- and macro-geometrical errors depends highly on the proper coordination of these two actions. The nature of

oxide film both in terms of physical nature and electrical properties plays a vital role. The current intensity, electrolyte concentration, stick-out pressure and abrasive grit-size are the major players affecting the surface roughness improvement significantly. If a unique coordination of EC and mechanicalprocesses is achieved, ECH can provide an unmatched surface quality. ECH can be developed as a precision micro-finishing process for the critical components of tribological relevance.Development of an ECH set-up is reported. ECH can be thought of as an interaction process of controlled electrolytic dissolution and selective mechanical abrading, the efficiency of which in correcting micro- and macro-geometrical errors depends highly on the proper coordination of these two actions. The nature of oxide film both in terms of physical nature and electrical properties plays a vital role. The current intensity, electrolyte concentration, stick-out pressure and abrasive grit-size are the major players affecting the surface roughness

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The development of electro chemical grinding set up is reported. It can be observed that the material removal rate and machining efficiency could be improved a lot when a proper high electrode feed rate is applied. A proper high applied voltage and electrolyte temperature is conductive to improve the maximum electrode feed rate and material removal rate. From the experimental study of the process, it can be stated that ECG is an efficient process for producing a surface with nanometric level surface finish on various materials such as metals, glasses and ceramics. This technique needs fundamental analysis of expertise to produce the desired results. The accuracy of the process can be increased by integrating the advanced motion controlling devices and intelligent processors with the experimental set up.

Regarding the working performance of the machine, it can be concluded that it works satisfactorily even under any extreme working condition. This procedure of development of such systems for obsolete conventional grinding machine would help industries. The theoretical results have been experimentally verified and found them within the closure range of acceptance for industrial exploitation. Some of the observations and results are highlighted as concluding remarks:

•The material removal rate increases with current density.
•MRR due to mechanical action is very low as compared to that of electrochemical action.
•The feed force is very less as compared to conventional grinding.
•The metal removal rate and surface finish obtained are within satisfactory range.

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INTRODUCTION TO ELECTROCHEMICAL HONING PROCESS:

Honing is an abrasive machining process that produces a precision surface on a metal work piece by scrubbing an abrasive stone against it along a controlled path.Honing is primarily used to improve the geometric form of a surface , but may also improve the surface texture.Hone tool has a combined motion of rotation and translation.

ElectroChemical Honing is a hybrid process of electrochemical machining (ECM) and mechanical honing. It combines the fast material removal capabilities of ElectroChemical Machining and controlled functional surface generating capabilities of mechanical honing in a single operation. ElectroChemical Honing is a precision process capable of producing a very good surface quality having a cross-hatch lay pattern required for many purpose like lubricating oil retention. It makes ElectroChemical Honing an ideal choice for finishing, improving the surface integrity, and increasing the service life of the critical components such as internal cylinders, transmission gears, carbide bushings and sleeves, rollers, petrochemical reactors, gun barrels most of which are made of very hard and/or tough, wear-resistant materials generally susceptible to heat distortions. Consequently, ElectroChemical Honing are used in the automobile, avionics, petrochemical, power generation, and fluid power industries. .

Different Types Of Honing Tools

HONING STONE:

Honing uses a special tool, called a honing stone or a hone , to achieve a precision surface. The hone is composed of abrasive grains that are bound together with an adhesive. Generally, honing grains are irregularly shaped and about 10 to 50 micrometers in diameter (300 to 1,500 mesh grit). Smaller grain sizes produce a smoother surface on the work piece.

A honing stone is similar to a grinding wheel in many ways, but honing stones are usually more friable so that they conform to the shape of the work piece as they wear in. To counteract their friability, honing stones may be treated with wax or sulfur to improve life; wax is usually preferred for environmental reasons.

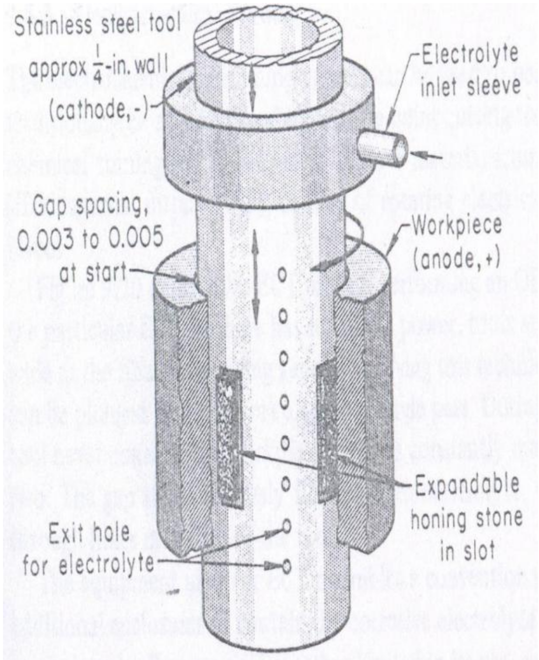
Any abrasive material may be used to create a honing stone, but the most commonly used are corundum , silicon carbide or diamond . The choice of abrasive material is usually driven by the characteristics of the work piece material. In most cases, corundum or silicon carbide are acceptable, but extremely hard work

piece materials must be honed using super abrasives.
The hone is usually turned in the bore while being moved in and out. Special cutting fluids are used to give a smooth cutting action and to remove the material that has been abraded. Machines can be portable, simple manual machines, or fully automatic with gauging depending on the application.

ELECTROCHEMICAL HONING:

It is a process in which it combines the high removal characteristics of Electrochemical Dissolution and mechanical abrasion of conventional honing.It has much higher rates than either of honing and internal cylindrical grinding.Cathodic tool is similar to the conventional honing tool, with several rows of small holes so that electrolyte could enter directly into electrode gap.Electrolyte provides electron through the ionization process which acts as coolant and flushes away the chips that are formed off by mechanical abrasion and metal sludge that results from electrochemical dissolution action.

ELECTROCHEMICAL HONING TOOL CONSTRUCTION:

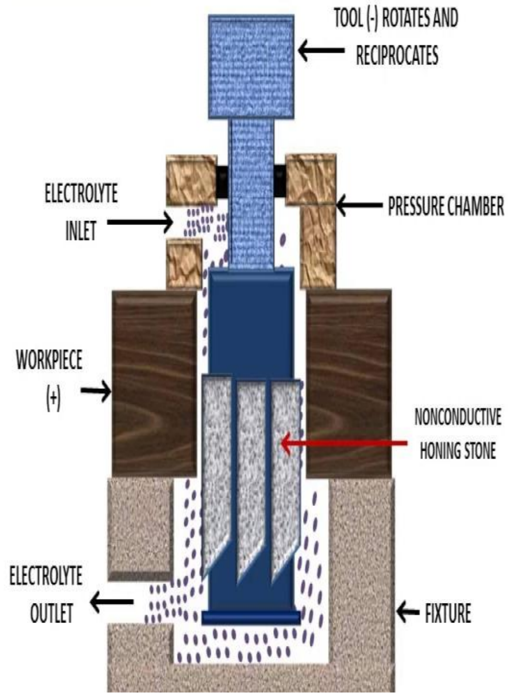


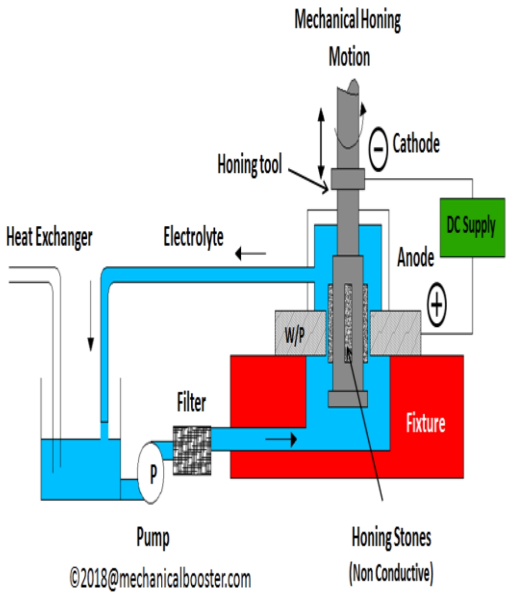
Tool consists of a hollow stainless steel body that has expandable, non conductive honing stones protuding from at least three locations around the circumferance .The honing stones are identical with those used in conventional honing operations, except that they must resist the corrosiveness of the electrolyte.The honing stones are mounted on the tool body with a spring-loaded mechanism so that each of the stones exerts equal pressure against the work piece.The length of the stones is selected to be approximately one-half the length of the bore being processed.

ELECTROCHEMICAL HONING PROCESS:

Tool is inserted inside the worked hole or a cylinder. Mechanical abrasion takes place first by the stone or hones.Oxides formed due to working from previous process will be removed by it and clean surface will be achieved. Now the clean surface will be in contact with electrolyte and then Electrochemical dissolution will remove the desired material.Same procedure is continued till the required cut is made.To control surface roughness Mechanical Abrasion is allowed to continue for a few seconds after the current has been turned off.

Majority of the material is removed by the ECD phase. Abrading stones remove enough material to generate a round, straight, geometrically true cylinder.Mechanical abrasion just removes the surface oxides that are formed on the work surface due to ECD. Removal of oxides enhances the performance of ECD as it could directly remove the required material and fresh surface is obtained for each ECD phase.





Electrochemical Honing Process

ELECTROCHEMICAL HONING WORKING:

In the ECH , electrolytes like sodium chloride, sodium nitrites are used.At the beginning of the ECH cycle, the stones protude only 0.075-0.127mm from the stainless steel body, establishing the gap through which the electrolyte flows. Here the abrasive tool is inserted into the work piece.The electrolyte enters the tool body via a sliding inlet sleeve from which it exits into the tool-work piece gap through small holes in the tool body.After passing through the gap, the electrolyte flows from the work piece through the gap at the top and bottom of the bore.

The work piece acts as an anode and abrasive tool acts as cathode. As the metal part of the tool apart from stones is conductive, it reacts with the electrolyte.The mechanical action of the tool is the same as with conventional honing, the tool is rotated and reciprocated so that stones abrade the entire length of the bore.Electrolytes used in ECH are essentially the same as those used in ECM, although the control of pH, composition and sludge is less critical because the abrasive action of the stones tends to correct any resulting surface irregularities.As in the ECM, the electrolytes are recirculated and reused after passing through appropriate filtration, and the most commonly used electrolyte are sodium chloride and sodium nitrate.The abrasive stones gives the final and neat finishing.

ELECTROCHEMICAL HONINGPROCESS CHARACTERISTICS:

Abrasive stones are used to maintain the gap size of 0.075 to 0.25mm.Surface finish ranges from : 0.2 to 0.8 micrometer.Electrolyte temperature is nearly maintained at 38-40 degrees Celsius.Pressure of 1000kPa.Flow Rate: 95 L/min.DC Current is Used.Voltage gap of 6 to 30V is kept accordingly.Current Density of 465 A/cm^{2}Cross-Hatched Cut surface is obtained after machining which is most desired after any load bearing surface.Tolerance can be achieved is as low as +/-0.003mm.Material removal rate is 3 to 5 times faster than conventional honing and 4 times faster than that of internal cylindrical grinding.

ELECTROCHEMICALHONINGCONFIGURATIONS:

Track or Raceway honing.Spherical honing.Taper and straight honing.Flat honing.Bore honing.

ELECTROCHEMICALHONINGAPPLICATIONS:

Cylinders for internal combustion engines, air bearing spindles and gears.There are many types of hones but all consists of one or more abrasives stones that are held under pressure against the surface they are working on.In terms of sharpening knives, a honing steel does not actually hone knives, but simply realigns the metal along the edge.ECH is widely used in the petrochemical and power generation industries.It is also used in correcting the gear teeth errors.The ECH is used for processing different materials like carbide, titanium alloys, Inconel, Incoloy , Titanium alloys etc,It is also used in increasing the lifespan of the roller , sleeves , dies, gears , internal cylinder.Can duplicate over a number of components.Example: 19mm diameter bore of a carburized pinion gear made of 8620 steel and hardened to HRC 60-62 was hone by ECH; 0.05mm of material was removed from the bore in 4sec with an accuracy of +/-0.002mm; conventional honing required 18sec/part and consumed 300 percent more abrasive.

ELECTROCHEMICAL HONINGADVANTAGES:

Low tolerance.Good surface finish is achieved.Small correction on work pieces is possible.Shaping and surface finish is done in one process.That means no need to spend your time separately for surface finish and shaping.Light hone pressure is used in the process, heat distortion is avoided.Due to Electrochemical Dissolution phase , no stress is accumulated and it automatically deburrs the part.In case hard materials, the traditional machining technique are not applicable . But this is the perfect process for hard or tough materials.No heat is produced during this technique .

It gives you one of the best surface finishing.This method gives you the desired low tolerance.Lets take a brief glance at material removal rate of this process.This material removal rate is 3 to 5 times quicker than the normal traditional machining process. Comparing its metal removal rate to the cylindrical grinding then , it is 4 times that of cylindrical grinding.Cooler action leading to increased accuracy with less material damage.As with all ECM-based , processes, ECH imparts no residual stresses in the work piece.Capable of achieving surface finishes of 0.05micron and dimensional accuracies of +/- 0.012mm.By turning of the power to the tool before the end of the honing cycle, the stones can be used in the conventional manner to achieve tolerances of +/-0.002mm and to impart a compressive residual stress in the work surface.

ELECTROCHEMICALHONING DISADVANTAGES:

Machinery cost is high.Machining cost per piece increases as it is an addition process.More numbers of equipment are required during this process.Skilled labour is needed to implement this metal removing process.It is only applicable to hard material mostly.

II. CONCLUSION:

Electrochemical Honing is one of the potential hybrid machining process which combines the mechanical abrasion and electrolytic dissolution in single operation. In the present work, the detail description of electrochemical honing tool construction, electrochemical honing process and process characteristics have been discussed. It is evident that the process is highly capable of improving the surface finish. Moreover, like most of the hybrid machining processes, ECH is also at starting stage and therefore a sustained global research is required.

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