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TEMPERATURE ANALYSIS AND OPTIMIZATION OF WORKING PARAMETER FOR MAGNETIC ABRASIVE PROCESS –A REVIEW

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ABSTRACT

The demand for advanced materials has been due to superior mechanical properties and high-quality surfaces in the engineering industry. To achieve high quality of surface finish, non-traditional finishing process can be used in place of traditional finishing methods. The magnetic abrasive finishing (MAF) process is an advance machining process to enhance the surface quality of certain materials such as ceramic, composites and hard alloy. The rate of surface finishing and quality through the MAF process depends on the varies parameter such voltage, current , ,magnetic field, abrasive quality and working gap etc. rise in temperature can also be a considerable factor during MAF process, because high rise in temperature can deform the surface microstructure and diffuse the abrasive particles. This review paper mainly focuses on the effects of process parameter and output parameter along with recent development and scope.

Keywords: Magnetic abrasive finishing; cylindrical magnetic abrasive finishing; plane magnetic abrasive finishing; surface roughness; removal weight, temperature.

INTRODUCTION

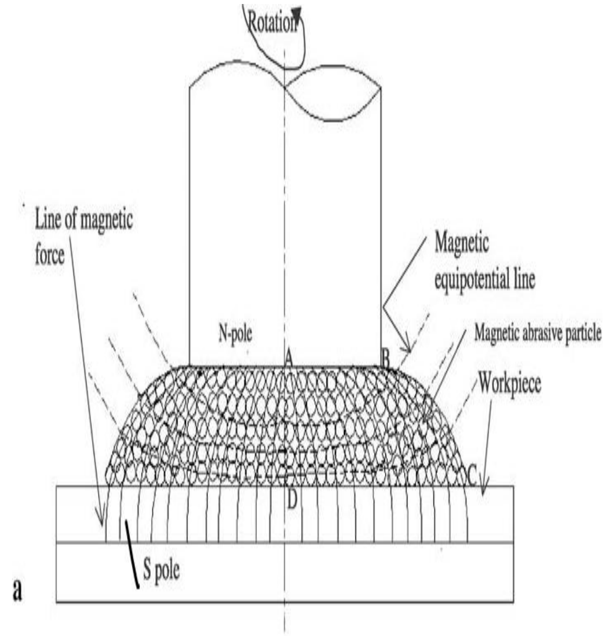
Now a day industry have demand of very high surface quality of products with dimensional accuracy, But It is impossible to achieve desirable accuracy with the help of conventional process. Conventional method (grinding, lapping, polishing, burnishing and honing) achieve high surface quality but not up to the marks. Magnetic abrasive finishing process is unconventional process which completes the industry demand .it is applicable for both ferrous and non-ferrous material. Being micro-finishing process .It's give better surface finish with accuracy. It's come in light first time in 1940 in the Soviet Union, Bulgaria but generally the practical use in 1980 and 1990s. It has been used in aerospace, medical field automobile sector .also use in polishing of better finishing of material.

Principle of MAF

MAF process is an advanced finishing process that finishes engineering materials such as ceramic, composite, and super-alloys. This process had grown into a sophisticated finishing operation, producing impeccable surface texture without altering surface integrity. In, MAF process magnetic field is used to control the magnetic abrasive particles (MAPs). In the MAF process different parameter affecting the process mainly such as voltage, working gap temperature, abrasive particle shape and size .Working gap act to remove the material from the target surface. MAPs were created by mixing abrasive particles with larger ferrous particles in proper proportions. MAPs create a magnetic abrasive brush (MAB) under the effect of magnetic field and acted as multipoint cutting head capable in dislodging the material in-form of micro to Nano chips. A substantial amount of heat was produced due to plastic deformation and rubbing between brush-finishing surface during finishing. Excessive temperature lead to surface contamination by fusing abrasive particles in the finishing zone and shows the thermal strain hardening and corrosion tendency might increase due to alteration in chemical composition of work-piece surface due to presence of excessive temperature.

Advantages of MAF

Using MAF process low forces generate and mixed unbounded or bounded abrasive particles, the damages to the surface can be minimized. It use for all types of material. Either hard or soft material .In the MAF process the abrasive particle which was used for cutting but there are no need of dressing the tool .In the MAF process both Ac OR Dc supply used . The advantages of MAF over other alternative processes such as super finishing, lapping, and honing are listed below:



• The finishing of mutually perpendicular surfaces (such as cylindrical and conical surfaces), other combinations (such as finishing the outer diameter and radii of a piston ring), and similar parts is possible.
• Work piece surface is free of buns and thermal defects.
• Low energy consumption in this process.
• It is simple to implement.
• It is ecologically safe.
• It produces Self-adaptability.
• Controllability is easy.
•Substantial improvement in wear resistance, as well as mechanical and physical characteristics.
• Nonferrous materials used such as magnesium alloy, aluminium and its alloys or brass and its alloys, can also be finished with ease.

Impact of temperature in MAF process.

Kato and Fujii [1] developed a new technic for measurement of temperature distribution in a cutting tool like as PVD (physically vapour-deposited), film was used in form of thermal sensor during surface grinding process.

In PVD film technique work piece stable on co-axial in a grinding direction. The deposition of vapour is a material with a fixed melting point on the internal surfaces. The two parts are tied together, which the picture is given. After the grinding test the interface is viewed with a microscope, then the unlisted film zone at the interface can clearly identify the boundary between the molten film zone. Work piece was stainless steel (SUS304).its temperature in the unmelted zone is lower than the melting point of the deposited film.

It is used cnc surface and profile grinder wheel are aluminium oxide wheel and Wheel speed Vs. =27.5 m/s, working speed is Vw =0.5 m/s, depth of cut a = 0.02 mm, melting point of 545 K. Therefore, it is possible to measure the intrinsic temperature in the work piece by using this PVD film technique with these parted work pieces fastened together as one work piece.

Rahul S Mulik et.al [2] Investigated the modelling of temperature using ultrasonic Assisted magnetic abrasive finishing process .they use electromagnet with ultrasonic vibration generator unit ,transducers (piezoelectric) because of ,it is difficult to surface finish hard material .the vibration unit provide vibration .the entire setup placed on the table of milling machine .they used K type thermocouple for temperature measurement because it get exact value .in this work the unbounded mixture material (Ferrous and abrasive) is 1.2 to 2.8 gm of silicon carbide with 98.5% of iron (300 Mesh) .they use work-piece AISI52100is alloy element contain(Cr,Ni,Si,Fe) and using working gap 1.5 with 720units ultrasonic power supply under various parameter such as (voltage rotational speed) and they found 41℃ to 46℃ temperature respectively.

After experiment they found temperature variance in order to voltage ,weight of mixture (abrasive and iron) and rotational speed .if they increase the voltage ,flux density increase due to this temperature increase because they increase the strength of flexible brushes .if increase the weight the temperature increase because more weight provide more cutting edge .

The temperature decreases with increase in the RPM because higher speed gives more centrifugal force and it have chance to topple over them.

Xipeng Xu et. al[3] Study the comparison of method to find the temperature .there are three types of the temperature measurement such as The embedded thermocouple, optical fiber with infrared detector and foil/work-piece thermocouple because grinding process requires high energy input as compared to other machining process . the temperature recorded all the three types and they have slight variations in grinding power pass to pass .the temperature measurement in both types embedded thermocouple and infrared detector become higher from pass to pass as the grinding zone and the temperature response of foil/work-piece have based on two component background temperature and periodic flash .

Gurvinder Kumar et.al [4] Focus on abrasive particle in MAF process. There are two type of material particles such as SiC, Cr2o3, and iron but they combined such a manner one bonded and other unbounded. Mixing the abrasive powder with iron like as sintering process, in this process iron is used for bonding and abrasive are used for cutting**.** The Mean diameter of the magnetic particle ranges 100 to 400μm, Mean diameter of the abrasive grain (μm) near 1 to 30μm,.and used mixture homogeneous.

Rajneesh Kumar et.al [5] was done experimental study in MAF process. during process they focused on temperature . they found in MAF process temperature rise 9℃ they also investigate other affected MAF process parameter such as voltage, surface finish ,working gap ,etc. MAF process not effected the structural change of the material. Flexible-MAB was formed when MAPs aligned with magnetic forces in the machining gap present between cylindrical part and electromagnet, which enhanced the surface finish of outer surface cylindrical work piece.

Conclusion

MAF process is useful process for the surface finish .it is advance process for surface finishing. Generally used in automobile sector, aerospace and also medical field .MAF process is done with advance material like alloys, which have special property .The setup cost is high in comparisons to other but finishing is better .one little thing is that its time consuming and seeing the temperature effect is not so affect the process so microstructure is free from temperature.

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