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# DEVELOPMENT AND OPTIMIZATION OF WORKING PARAMETER FOR MAGNETIC ABRSIVE PROCESS –A REVIEW

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## ABSTRACT

Magnetic abrasive finishing is the advance-grade types of the machining process leading to micro/ nano finishing process. The process depends upon the magnetic field, abrasive particle, iron powder and working material. There are two type of magnetic field such as stationary and rotary field. Abrasive particle such as diamond, silica carbide and aluminium oxide can be used for MAF process. When we focus on the magnetic field then we find the stationary or rotating magnetic field, abrasive particle such as diamond, silicon carbide, aluminium oxide etc. and the working material are such as alloy based like stainless steel and its alloy, brass, aluminium and its alloy magnesium alloy and many others ,means its applicable for both ferrous and nonferrous material. The process magnetic abrasive finishing giving micro level finishing surface using unbounded abrasive particle working as the like flexible brushes and rubbing the workpiece material. in order to achieve the better finishing surface to attain the different process parameter like as, working gap between the setup and workpiece material, abrasive particle , iron powder ,machining oil ,rotational speed ,voltage ,surface roughness, material removal rate, supply ac/dc ,flux density , vibration, etc.In this review paper examined the working principle, process parameter, limitation future development is discussed.

**Keywords**: - Magnetic abrasive finishing, material abrasive, MRR.

## Introduction

Traditionally we use many super finishing process ,but magnetic abrasive finishing process is advance process of finishing its form of micro-finishing process with the help of magnetic field and abrasive particle .we produce magnetic field between workpiece and abrasive particle and provide rotational speed so that centrifugal force generated in unbounded abrasive particle ,they work like a flexible brushes and rub the workpiece like polishing .

MAF process which was acquaint during the late 1940s has shine as an important nontraditional metal finishing process. Initially, developed as a machining process in the US in the 1930s, in the 1940s MAF first patent. University research in the Soviet Union, Bulgaria, Germany, Poland, and US began in the 1960s. The practical usage of MAF appearing by the 1980s and 1990s. The growth of the semiconductor, aerospace, and optics industries have continued development of better process for achieving high form of accuracy and surface finishing.

**Fundamental of Magnetic abrasive finishing**

MAF process depends upon the two main things such as magnetic field and magnetic abrasive if we concern about magnetic field we found two ways such as permanent magnet and electromagnet both way produce magnetic field and uses magnetic abrasive (Silioncorbide, aluminium oxide ,Dimond etc.) with mixing the iron powder in fixed portion by weight or by part ,when electric field giving to the setup the magnetic field induced and mixed (abrasive +iron powder ) abrasive attract the pole and by rotational speed the work as the flexible brushes with in the working gap between pole and the mixed abrasive can finishing the surface providing material or workpiece. axial vibration is important things to provide a better surface finish neither abrasive make a ring towards the workpiece and other parameter giving great impact to surface finishing and material removal in micro level.[1]

MAF can be used very easily for complex shapes and inner and outer surfaces of tubes, which are difficult to finish using traditional finishing processes. MAF is used for magnetic or non-magnetic materials, it can be also useful for any shape of materials.

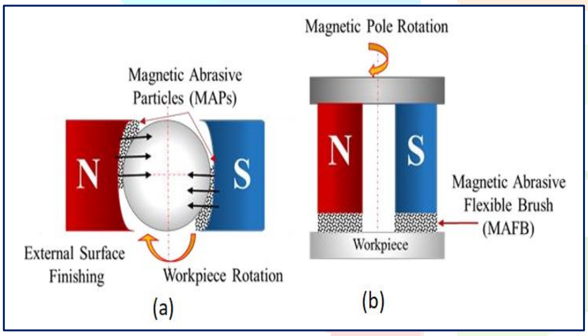


Figure 1: Examples of existing MAF methods, (a): Fixed magnetic source with rotated work piece (b): Rotated magnetic source with fixed work piece.

**Magnetic Abrasive Preparation Methods**

**Sintering:** It is a simple technic for preparing abrasive charge from powder, by heating the material in a sintering furnace below its melting point (solid state sintering) until its particles adhere to each other. Sintering is usually used for manufacturing ceramic, & has also found uses in powder metallurgy.

**Adhesive Bonding:** A special type of adhesive is essential for obtaining a strong bond between magnetic materials and abrasive particles. The amount of adhesive in mixture of abrasive and Ferro magnetic components was decided in such a way that adhesive completely wets the mixture and should not behave like a fluid.

**Experimental and simulated investigation of response outcome**

**Impact of process parameter on Surface Roughness and Material removed rate:**

Surface finish and materials removal rate is most important function of any maching process. In the case of MAF surface finish is desirable rather than the material removal because its finishing process. For assembly purpose dimension accuracy and surface quality play a very important role. Keeping all the requirement researcher mainly focused on improvement of surface quality. **Yoon et al (2)** Investigated the surface roughness of STS 304 improved by 50.9%, 70.6 %, 63.6% and 75.5% respectively. Because they using magnetic pole arrangement such as 4(four) different magnetic pole arrangement which include N single, N-S 90°C, N-S 180V and N-S-N arrangement. **Imet al.(3)**Investigated the surface roughness and removed weight using STS 304 bar and they found improved surface roughness when used and they used different grain size (1,3 and 9µm).When we focus on the removal rate the best result found when 3 µm diamond abrasive particle used.

**Wu and Zau et at. (4)** Investigated on the SUS304 stainless steel pulsating low frequency alternating magnetic field roughness improved from 240.24µm to 4.38 µm and other parameter help for the improving the result such as magnetic pole. Rotational speed and grinding the help for better surface finish and higher removal rate. In the MAF process surface finish and material removal rate of the workpiece, increased when the working gap magnetic abrasive flexible brushes getting stronger and giving large amount of material removal due to deeper cuts. **Jain etall(5)** Investigated the surface finish and material removal rate according to the working gap total material removed in 300s/linear distance travelled by the w/p 300s. In the term of surface finished up to 4µm is minimum in the 0.5mm of working gap. **Jain et al. (5)-(2)**Investigated on the stainless steel cylindrical workpiece mounted on a lathe machine tool using iron powder 300 mesh size (51.4µm) and abrasive powder Al2O3 of 600 mesh size 25.7µm, and lubricant used sero spin-12 oil and find the better surface finish with working gap 0.4-0.7mm height in the 0.5mm. **Singh et al(6)-(1)**They were analysis, when they apply the Taguchi design of experiments and found the working gap ,voltage and the most important factor of surface finishing followed by the rotational speed and different mesh size number in order to achieved better surface finish and material removal . **Givi et al (7)** Investigated on the Aluminium plate for finishing and effect of other parameters such as working gap, rotational speed, pole number and arrangement of cycle. they found the working gap has important effect on the surface finish for higher working gap decrease surface roughness and lower working gap giving higher surface finish and using methodology (ANOVA) technique.

Rotational speed and axial vibration is one of the most important parameters because chips were generated during finishing and chips removed from the work piece causing relative motion between magnetic abrasive and the work piece and without axial vibration magnetic abrasive making a grove on the work piece due to centrifugal force generated and abrasive particle moving in a form of ring. **Im et at (3)-(2)** Investigated the surface STS-304 stainless steel bar (fie3 150mm) and the rotational speed 30,000 rpm with 0 Hz and 12 Hz of vibration In the case of 0 Hz vibration they found surface roughness improved much more in initial condition but after some time it gone worse, approximately 60 second of processing. In the case of 12 Hz vibration the surface roughness improved till 30second of processing after that it will remain same, approximately.

In the magnetic abrasive finishing process the setup used as a generally electromagnet **fox et al (8)** Investigated that when they provided various flux density they found variation of surface finishing they found when they increase the flux density (0.17Tto .37Tesla ) result was improve in the form of surface finish up to the saturation level . **Galsokav et al (9)** studied the lubricant in magnetic abrasive finishing they provide cooling effect and it take a important role because cutting fluid react chemical for mechanically weak compound. sometimes lubricant giving penetration fluid with good wetting property give better surface finish 5 to 10% solutions of Emuls01 E2 (soluble oil) **Fox et al (7)-(2)**investigated the effect of lubricant and found during operation solid lubricant give to the abrasive brushes more flexible so that ability to produce better surface finish.

**Effect of temperature:** Rajneesh Kumar Singh et-at all- study on surface micro finishing of Aluminium 6060 using MAF process, in this process low heat generated and free from thermal stress such as 9°C rise in temperature was achieved using Buckingham π method to achieve it and find average error 7.31 %. They were using drill machine setup for MAF to rotate a magnetic field using K type thermocouple and stationary the workpiece.

## Conclusion

Magnetic abrasive finishing process is very useful for achieving dimensional accuracy with high quality of surface texture. It is broadly useful in industrial and medical field which require micron level of surface finish. Nonferrous materials used, such magnesium alloy, aluminum and its alloys or brass and its alloys, can also be finished with ease. Materials removal rates and surface finish are two vital working parameter that depend on the working gap and flux density. Stirring effect improve the performance magnetic brush and improve surface quality. Workpiece surface is free of buns and thermal defects. Magnetic abrasive finishing process is Ecologically safe but high cost price.

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