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# INVESTIGATION OF SURFACE ROUGHNESS OF GRINDING WHEEL FOR GUN METALS

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## ABSTRACT

The challenges facing machining industries today are high metal removal rate and better product quality. Grinding is vital to many manufacturing processes as it generates finer surfaces and closer dimensional tolerances. The selection of the machining parameters is crucial for a better performance in the grinding process. In our project we are going to compare the surface roughness and material removal rate for cylindrical grinding wheel with conventional grinding wheel. The parameter are different wheel composition, depth of cut and wheel speed for machining gunmetal. The parameter on grinding process should be controlled to get best surface roughness.

## INTRODUCTION

Grinding is the process of removing metal by the application of abrasives which are bonded to form a rotating wheel. When the moving abrasive particles contact the work piece, they act as tiny cutting tools, each particle cutting a tiny chip from the work piece. The grinding machine supports and rotates the grinding abrasive wheel and often supports and positions the work piece in proper relation to the wheel. The grinding machine is used for roughing and finishing flat, cylindrical, and conical surfaces; finishing internal cylinders or bores; forming and sharpening cutting tools; snagging or removing rough projections from castings and stampings; and cleaning, polishing, and buffing surfaces.

## LITERATURE REVIEW

**M. Janardhan,** et al has worked on optimization of cylindrical grinding process parameters using Taguchi method and regression Analysis in 2007. They has used orthogonal array and anova method in order to improve the productivity of process and quality of surface of high alloy refractory material and mild steel obtained by taking various parameter and concluded that The predicted optimal values for MRR, Ra for Cylindrical grinding process are 62.05 gm/min and 0.816 µm respectively . The results reveals that feed rate, depth of cut are influences predominantly on the output responses metal removal rate (MRR) and surface roughness (Ra). **Jae-seob** et al has worked on analysis of grinding power and surface roughness in external cylindrical grinding of hardened scm440 in 2005. They has used response surface method for analyzing the grinding power and the surface roughness in the external cylindrical grinding of the hardened scm440 material by using the grinding parameters, the second-order response surface models for the grinding power and the surface roughness in the external cylindrical grinding were developed. Therefore, it is possible to predict the grinding power and the surface roughness before conducting grinding. **George**, et al has worked on cylindrical grinding process based on Taguchi method of optimization in 2013. They has discussed

about the working of cylindrical grinding machine and effect process parameter on surface roughness. They also formulate relationship between the surface roughness values and the input parameters. They has concluded that optimum value of surface roughness is 0.47 Ra. In their work the values of surface roughness varies from 0.47 to 0.79 Ra **Kirankumar** et al has worked on cylindrical grinding process parameters for AISI 5120 steel in 2011.They has discussed that today surface roughness is required with closer tolerances and cylindrical grinding is one of the important metal cutting processes used extensively in the finishing operations. Metal removal rate and surface finish are the important output responses in the production with respect to quantity and quality respectively .The experiment were conducted on cylindrical grinding machine using EN8material(BHN=30-35) and he found that the feed rate played vital role on responses surface roughness and metal removal rate than other process parameters. **Kiyaka** et al has worked on external cylindrical grinding. They has carried out experimental study in dry and wet (%5 emulsion cutting fluid) machining conditions using aisi1050 steel at various work piece speeds and feed at constant wheel speed and grinding depth. They has concluded that to obtain better surface quality in dry grinding should be completed at high work piece speed and low feed. However, in wet grinding, both work piece speed and feed should be kept low for a lower surface roughness.

## SELECTION OF GRINDING WHEEL MATERIAL

- G rinding wheel 1:Copper+ green sand+ epoxy
- G rinding wheel 2:Magnesium+ silicon carbide+ isopolymer

## TESTING

An experimental work is carried out for the bronze and gunmetal materials. Good quality cuts are possible at high cutting rates by proper control of cylindrical grinding machine. The experimental work presented in this chapter shows the study conducted as these characteristics such as surface roughness and material removal rate as a output parameter with reference variable input parameter such as grinding wheel speed and depth of cut.

## SURFACE ROUGHNESS MEASUREMENT

The Surface roughness for all trial runs is measured with profile meter named SJ-210 and their technical specification as under future below.

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**FIGURE 5.1 SJ-210- SERIES 178-PORTABLE SURFACE ROUGHNESS TESTER**

## MATERIAL REMOVAL RATE (MRR) MEASUREMENT

Material removal rate is measure with the help of theoretical equation which constant weight before machining, weight after machining and machining time.

MRR= (weight before machining − weight after machining) ÷ Machining time.

| GRINDING WHEEL | WHEEL SPEED (rpm) | DEPTH OF CUT (µm) | SURAFCE ROUGHNESS $R_a$ (µm) | MRR |
|---|---|---|---|---|
| Mg+SiC+Isopolymer | 500 | 10 | 0.161 | 0.055 |
| | 500 | 20 | 0.168 | 0.078 |
| | 500 | 30 | 0.179 | 0.121 |
| Cu+Sand+Epoxy | 500 | 10 | 0.154 | 0.064 |
| | 500 | 20 | 0.161 | 0.100 |
| | 500 | 30 | 0.167 | 0.163 |

**TABLE 5.1 OUTPUT VALUES FOR 500rpm WHEEL SPPED**

| GRINDING WHEEL | WHEEL SPEED (rpm) | DEPTH OF CUT (µm) | SURAFCE ROUGHNESS $R_a$ (µm) | MRR |
|---|---|---|---|---|
| Mg+SiC+Isopolymer | 650 | 10 | 0.165 | 0.058 |
| | 650 | 20 | 0.172 | 0.082 |
| | 650 | 30 | 0.183 | 0.124 |
| Cu+Sand+Epoxy | 650 | 10 | 0.157 | 0.067 |
| | 650 | 20 | 0.164 | 0.102 |
| | 650 | 30 | 0.171 | 0.166 |

**TABLE 5.2 OUTPUT VALUES FOR 650rpm WHEEL SPEED**

## CONCLUSION

The present experimental work was completely done with keen observation by optimizing the input parameters as possible in cylindrical grinding machine. Here, bronze and gunmetal materials were subjected to machining operation and relation amongst them was studied. From this experimental work it could be concluded that,

- Cylindrical grinding is a finest method to produce improved surface quality in machined components. Whenever the input parameters get deflected, it reflects on the outcome of the component. It may be depth of cut, cutting speed.
- In bronze and gunmetal materials, increasing depth of cut reduces the surface finish of component; meanwhile it increases MRR because more volume of material gets eliminated. Hence, the surface finish depends upon the depth of cut which is to be optimized.
- Cutting speed is a major impact on machining which determines the tool life and MRR. High cutting speed leads to more volume of material removed from work in a short time. Material removal rate is high in bronze and gunmetal Material and produces quality surface finish.

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