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A REVIEW ON DRESSING AND GRINDING OPERATION

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Abstract - *This paper presents a summary of numbers of researches done by the different authors on the dressing and grinding operations. Dressing is a conditioning process of grinding wheel to increase its efficiency and to make it more productive. Grinding is an abrasive machining process used for almost every manufacturing process to improve the surface finish with the help of abrasive grits. This paper reviews the various process parameters like dressing orientation, feed rate, depth of cut and number of passes and their effect on the surface roughness, grinding wheel performance and wear. And the recent development and progress in the field of dressing and grinding is reviewed from the different perspective.*

Key Words: *Grinding, Dressing, process parameters, surface roughness*

1. INTRODUCTION

Nowadays a wide range of grinding and dressing techniques are used for machining the variety of engineering materials. These processes include internal, cylindrical, centerless and surface grinding. Also, single point dressing and internal arc dressing are the types of dressing process. These methods are widely used in order to increase productivity and quality with better surface finish.

Grinding is an abrasive machining process of material removal used to shape and finish the different components made up of metals and non-metals. Since 2000 years, abrasives are used for shaping the material. In early times, resharpening of weapons, knives and tools were done by abrasive stones. Grinding as a manufacturing process was developed in 1959. Now, it is used for high technology applications such as aero engines and missile guidance system.

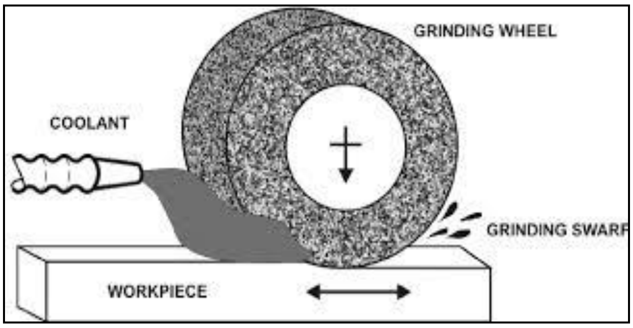

Fig. 1 Grinding Process

Dressing operation is performed to restore the shape of a grinding wheel. It is a finishing process of wheel to minimize the grinding forces and increase the grinding efficiency. Different types of electroplated, vitrified and metal bonded dressers are used for dressing operation. Also, optimization of some dressing parameters such as dressing orientation, depth of cut, number of passes and speed give the better results of grinding.

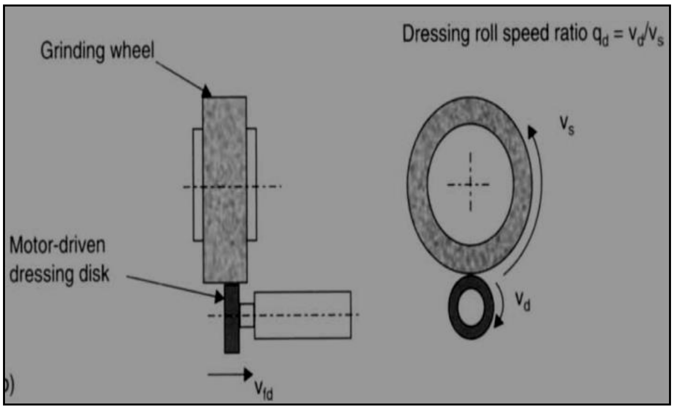

Fig. 2 Dressing Process

1.1 Advantages of grinding

There are number of advantages of grinding which are as follows:

- Simple in operation
- No advanced skill required
- Good dimensional accuracy can be achieved.
- Less investment
- Approximate surface finish can be achieved

1.2 Applications of grinding

- Grinding of different cutters and tools
- Surface finishing
- Internal and external cylindrical surface grinding
- Parting and slitting
- Descaling and deburring

2. LITERATURE REVIEW

Ujjawal Mayank Srivastava (2013) [1]: studied the grinding, dressing and truing operations. Grinding is a machining process used to finish the surface with the help of abrasives. The powder formed material is removed by the abrasive grits. Dressing and truing operations are performed on grinding wheel to improve the grinding efficiency. Dressing is a conditioning of grinding wheel aiming to improve the cutting ability. Truing is another process of restoring the wheel shape. It makes the internal and external surface concentric. Dressing is also subjected for tool life improvement. Different types of dressing such as conventional, unconventional, laser and EDM process have studied with their principle and functioning. They concluded that the less power is consumed by using dressed wheel and it is cost effective.

Z. Shi, S. Malkin (2006) [2]: investigated that wear of grinding wheel affects the grinding efficiency and surface topography of wheel. Electroplated carbon boron nitride (CBN) wheels are made up of single layer of super abrasive grains and electroplated nickel bond. They are widely used for machining of automotive and aerospace components. The experiments are conducted on internal grinding machine and observations of surface are done by Scanning Electron Microscopy (SEM). It shows the differentiation in shape, size, orientation and height of CBN grains. Surface roughness decreases with increase in active grain density. Wear of CBN grains is caused by grain fracture and grain pullout. Uniform grain fracture causes an increase in grinding efficiency.

Dadaso. D. Mohite, S.M. Jadhav (2016) [3]: investigated the effect of different dressing parameters like angle of dresser orientation, number of passes, depth of cut, feed rate for minimum surface roughness. The way of wheel dressing affects the grinding wheel performance. The optimization of process parameters is based on Taguchi method to get minimum surface roughness by using CNC cylindrical grinding machine. Analysis of variance (ANOVA) is performed to check the sensitivity of the input parameters. They concluded that surface roughness is more dependent on dressing feed rate than the other parameters. By multiple regression analysis, it is proved that surface roughness can be decreased by decreasing the feed rate, dressing angle and depth of cut.

A. Daneshi, N. Jandaghi, T. Tawakoli (2014) [4]: studied that dressing operation plays an important role in surface finish, wear of wheel and grinding forces. They considered different dressing approaches for abrasive grinding wheels in internal grinding. The experimentation is performed on two CBN wheels and two corundum wheels with vitrified bond and electroplated dressers. They concluded that grinding forces increase highly after dressing operation and decrease after some material removal of wheel. Also, they suggested keeping low feed rate at the beginning of grinding process and exactly after the dressing. This is given for opening of wheel pores and settlement of vitrified bond. The rate of wear and surface roughness are decreased by using ceramic CBN wheels.

Manoj Kumar Sinha, Dinesh Setti, Sudarsan Ghosh, P Venkateswara Rao (2014) [5]: investigated that the grit size of grinding wheel gives the performance of grinding operation. All the grinding operations like rubbing, cutting and ploughing are dependent on the abrasive grits. The experimentation was performed with different depth of cut and dressing lead. Variation in normal forces, tangential forces and surface roughness are observed with respect to depth of cut and dressing lead. The Genetic Algorithm (GA) optimization technique is used to minimize the grinding forces and surface roughness. They concluded that surface roughness decreases with decrease in dressing lead. Minimum grinding forces can be exerted with the optimum range of depth of cut. For some of the cases, maximum dressing lead gives the minimum grinding forces.

A. Sudiarso, J. Atkinson (2008) [6]: studied the electrical dressing method to overcome the disadvantages of conventional dressing method. This process consists of electro-chemical as well as electro-discharge processes and twin copper electrodes are used. A metal bonded diamond wheel is dressed with alternating current (AC) power supply. Different surface roughness is produced with traditional and electrical methods. From the comparison of two methods, the less surface roughness can be achieved by hybrid electrical dressing with twin electrodes using different power supplies.

Wei-Chin Lin, Shih-Fu Ou, Chao-Sung Lin, Yung-Ning Pan, Chingg-Jui Shih (2013) [7]: studied the properties of diamond. Diamonds have high heat transfer coefficient and high hardness. Brazing or electroplating methods are used for fabrication of diamond dresser. Corrosion resistance of diamond dresser is improved by the integrity of diamond-nickel interface. Two types of diamond dresser with micro columnar structure (CPD) and micro hemispherical structure (SPD) are compared with commercial dresser (BSD). CPD and SPD have higher corrosion resistance as compared to BSD. CPD has greater removal rate with the lowest height level.

Akram Saad, Robert Bauer, Andrew Warkentin (2010) [8]: Investigation is based on the effect of diamond roll and single point dressing processes in grinding. Two different models of surface roughness have studied with Scanning Electronic Microscopy (SEM) micrographs. It is studied that both the models have linear relationship with overlap ratio of single point dressing and interference angle for diamond roll dressing. Also, they are used to maintain constant material removal rate. The validation of relationship is done experimentally and used to achieve the desired surface roughness.

Li Xue, Fazel Naghdy, C. cook (2003) [9]: studied the effectiveness of Acoustic Emission (AE) sensors in dressing operation monitoring. Dressing is the resharpening process of grinding wheel in order to improve the cutting performance. There are number of parameters such as energy, force, temperature, wear and surface roughness are affected by dressing of wheel. The experiments are performed to study the assistance of AE signal while dressing. With the help of AE sensors, we easily detect the out-of-round wheel and wheel contour error. To maintain the consistent surface roughness in the grinding operation, monitoring the dressing parameters is must.

Vitor Meira Bilha, Paulo Andre De, Camargo Beltrao, Giuseppe Pintaude, Victor Beltrao, Claudia Tania Picinin (2015) [10]: studied the relation between surface produced by grinding process and opening pressure of diesel injector nozzle. Experiments are performed by using Taguchi methods to identify the signal-noise ratio to surface roughness parameters. The seat surface in nozzle is major contributor for getting efficient fuel injection. And its 2D roughness is measured by micrometer and 3D roughness by optical interferometer. SEM analysis is used to visualize the grinded parts, dressing and grinding wheel. It is concluded that seat Pt can be reduced by optimizing the process parameters. With the help of detection of surface quality issues, the waste in manufacturing can be reduced.

3. SUMMARY

From the above literature, it is concluded that there are various process parameters in the dressing and grinding operations which affect the response parameter in the different manner. Dresser orientations, number of passes, depth of cut and feed rate are more influencing parameters. And surface roughness is mainly affected by the dresser orientation and feed rate. Dressing angle and feed rate must be low for lesser surface roughness and to get the good surface quality. Also, dressing performance is dependent on the abrasive grain size of wheel. Optimum range of dressing parameters can give the higher grinding efficiency and lower grinding forces.

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