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Horizontal Abrasive Belt Grinding Machine - Review

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ABSTRACT

Grinding is a precision machining process which is widely used in the manufacturing of components which require close tolerances and smooth finish. It has become an important process for the material removal and finishing of different materials for several applications. Rapid developments in work materials and enforcement of stringent work specifications increase the demand for accuracy and surface quality of work pieces, with improved productivity and cost effectiveness. The wide spread use of new hard to machine materials also increases the demand for different grinding tools.

Innovative changes in manufacturing processes and methods are other important factors, opening up new applications for abrasive machining.The important feature that differentiates grinding from other machining processes is that the cutting points which are spatially distributed over the cutting surface. The number, geometry and dimensions, of the cutting edges can only be defined statistically. Higher cutting speeds, smaller depth of cut, specific wear behaviour and high temperatures are the specific characteristics features of grinding process.

Index items/ keywords – .Grinder, Abrasive belt grinding machine

1. INTRODUCTION

Grinding is a precision machining process which is widely used in the manufacturing of components which require close tolerances and smooth finish. It has become an important process for the material removal and finishing of different materials for several applications. Rapid developments in work materials and enforcement of stringent work specifications increase the demand for accuracy and surface quality of work pieces, with improved productivity and cost effectiveness. The wide spread use of new hard to machine materials also increases the demand for different grinding tools.
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The important feature that differentiates grinding from other machining processes is that the cutting points which are spatially distributed over the cutting surface. The number, geometry and dimensions, of the cutting edges can only be defined statistically. Higher cutting speeds, smaller depth of cut, specific wear behaviour and high temperatures are the specific characteristics features of grinding process.

In this advanced era of design and manufacturing we are of mechanical engineering are expected enhance the quality of polytechnic by applying knowledge and skills that we have gained from this particular three years course. so in order to complete the project of mechanical engineering. Abrasive Belt Grinding Machine is one of the type of machine use for purpose of grinding and finishing of material. they required a machine for grinding and super finishing of material as per their convenience. Coated abrasive belt grinding is different from traditional machining of parts of identical materials. The difference is in the way of chip production, the order of specific cutting pressure encountered and surface integrity of machined parts. For better understanding, a detailed literature survey has been carried out. A resume of the same is presented in this chapter. The literature survey has been grouped into three subgroups as analysis of material, wear behaviour of coated abrasives and evaluation of abrasive belt on different work piece.

Abrasive belt grinding is the one another common finishing process in the metal and wood working industries. Coated abrasive belts are used in the same speed range as bonded wheels, but they are not generally dressed when the abrasive becomes dull (Ernest et al 1990). The wide spread application of coated abrasive belts and long standing operating practices have led to different kinds of quality requirements. The abrasive belt machining technique is more significant for precision machining and finishing, also used for roughing.

2. LITERATURE SURVEY

Literature survey it is most important step in software development process. Before developing the tool it's necessary to determine the time factor, economy and company strength. **Belt Wear, Surface Finish and Material Removal Process in Belt Grinding**

Abrasive belt grinding is a common finishing process in the metal and wood working industries. Coated abrasive belts are used in the same speed range as bonded wheels, but they are not generally dressed when the abrasive becomes dull. The wide spread application of coated abrasive belts and long standing operating practices have led to different kinds of quality requirements. They have reported that the performance difference between solgel alumina grain and fused grains, it was observed, similar trend on material removal and belt wear for different work materials. Though the trend found to be same but the solgel grain gives more material removal, this is due more cutting points per grain. Precision grinding gives considerably lower material removal rates, but can engage large work-piece volume in view of large work-piece engagement areas possible. Thus wide belt machines can be used at in feed ranging between 5 and 10mm for economical machining of work-piece having a width of more than 2000mm.

Hugh Dyer (1955) investigated the dependency of certain controllable grinding conditions on the wear of abrasive grains. It was reported that belt speed influences the attritions and fragmentation wear. They have concluded that high belt speed leads to higher temperatures at the abrasive grain-metal contact. At low belt speeds fragmentation wear of the abrasive belt is promoted. It was concluded that the effective use of abrasive belt was related to the balance between attritions wear and fragmentation wear. The wear pattern of coated abrasive would be different from that of the bonded abrasives. The individual grains were subjected to unique load. Since the shape of the abrasive grains used for belt grinding is acicular and also friable, at higher belt speed grain may getting fragmented.

Hong et al (1975) have studied the effect of contact wheel on centre less belt grinding. Different kinds of contact wheel and its impact on output parameters were studied. It was concluded that metal base contact wheel gave better belt efficiency and dimensional accuracy on the finished part. Recha et al (2008), studied on the methodology on AISI 52100 Work.

Mcgibbonet al (1976) have stated that, in high-rate grinding applications, it was possible to achieve uniform abrasive wear on the coated abrasive belt. This uniformity of wear permits efficient usage of available coated abrasive area and aids in producing good flatness tolerance on the work pieces. In this study, abrasive belts were tested under selected operating conditions and test results were correlated with predictions. Abrasive wear of coated abrasives can be compared with the single grain evaluation.

Kazuhisa et al (1992), have studied the topography assessment of coated abrasive tape for distinguishing its functional performance. The three dimensional distribution of projecting abrasive grains on a tape surface was presented and the related geometrical parameters for classifying the coated abrasive tapes were proposed. A comparison was made between those parameters of the tape surface and the generated surface textured on the aluminium alloy substrate. The topographical parameters of textured substrate surface which are based on the profile amplitude. Micro geometry near the valley bottoms and their number were correlated fairly well with the spatial distribution of the effective coated abrasive grains in conjunction with working. The individual grain contact with work piece is influenced by the machine and product parameters.

Date et al (2001), have studied on effect of grit size on the initial performance of fresh coated abrasives and the deterioration of coated abrasive performance with continued usage. Abrasion tests were performed on pin-on cylinder set up which had removable segments for observing the coated abrasive surface in the scanning electron microscope (SEM). With the coated abrasives containing finer grit sizes, numerous adhesive wear particles were found on the coated abrasive surface. With continued usage, the rapid deterioration in performance with finer grits was accompanied by a build up of metal caused by capping of the abrasive grain tips with metal chips and by clogging due to metal chips and adhesive wear particles becoming stuck between the grains. Coarser grits, were found to experience extensive grain fracture followed by some grain capping and flattening but virtually no clogging, the deterioration in coated abrasive performance was very much less.

3. PRINCIPLE

The belt and work-piece revolve the depth of cut increases to a maximum, somewhere along the arc of contact of the belt and the work-piece and then reduces again when the chip is dislodged from the work-piece. Since the belt speed is considerably higher than the work speed, the maximum value of depth of cut is reached almost at the point where the belt leaves the work-piece. This depth of cut is termed as the grain depth of cut. In Figure 3.1, when the grain is at P it is just contacting the work-piece and the depth of cut is zero. In unit time T, the grain will advance to position R. The belt can be made to cut harder or softer by reducing or increasing the grain depth of cut.

Following are clear. i) Work speed – By increasing the work speed, the grain depth of cut increases and the bond wears out faster and the belt appears softer. When the work speed decreases, the belt appears to be harder. ii) Belt speed – By reducing the belt speed the grain depth increases and the belt appears softer. By increasing the belt speed, the belt appears harder.

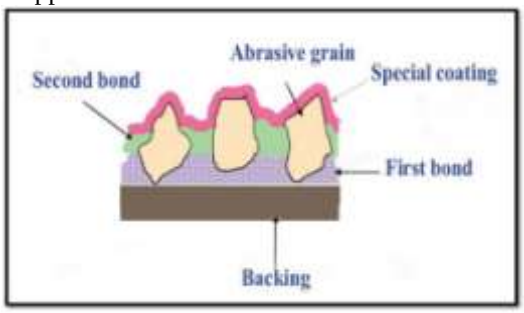

Figure: 3.1Grinding Belt Showing Edge of Abrasive Grains.

Grinding removes the metal from the work piece in the form of small chips by mechanical action of abrasive particles bonded together in a grinding belt. Rubbing, Plowing and Metal removal are the three stages of chip removal process in grinding. Grinding is a slow process in terms of unit removal of the stock. Hence, other methods are used first to bring the work closer to its required dimensions and then it is ground to achieve the desired finish. In some applications, grinding is also employed for higher metal removal rate. In such heavy duty grinding operations more abrasive is consumed. In these cases, the main objective is to remove more amount of material that too as quickly and effectively as possible. Thus, the grinding process can be applied successfully to almost any component requiring precision or hard machining and it is also one of the widely used methods of removing material from the work piece after hardening. The process quality basically depends on a large extent on the experience of the operator. sModern grinding belt and tools are generally composed of two materials, one is the tiny abrasive particles called grains or grits which do the cutting and the other is a softer bonding agent to hold the countless abrasive grains together in the solid mass.

Power is on rollers are revolve speedily. Rollers fitted with bearing. Abrasive belt mounted on rollers. It revolves around with rollers.

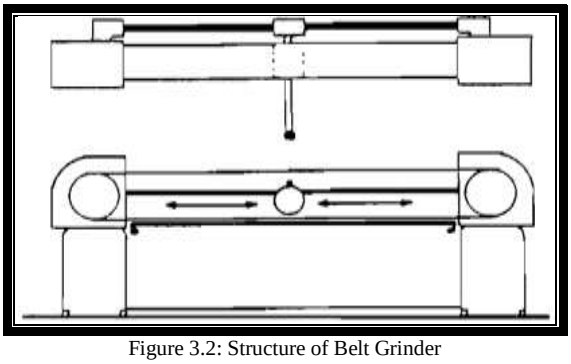

Figure 3.2: Structure of Belt Grinder

3.1 Grinding Methods

Wide belt grinding is the one another familiar process in industry as well as home applications. There are some basic methods for belt grinding.

- Stroke belt
- Platen belt
- Wide belt

In general, there are three basic elements of the belt-grinding machine: which are work rest support, grinding head and a regulating head. These components differ for all the methods but in general the work piece is pressed between the grinding head and the rest support. The aim of the regulating head is to coordinate the belt pressure. Wide belt grinding One of the most common methods is the wide belt grinding. The machines can be made for the wet or dry operation. a wide belt grinding machine can be constructed with the single or multiple heads. The first head is mainly used for coarse grinding and the next heads gradually make a finer finish. Wide belt grinding is also mainly used as a high stock removal method for special metals (e.g. stainless steel, titanium, and nickel alloys).[3]

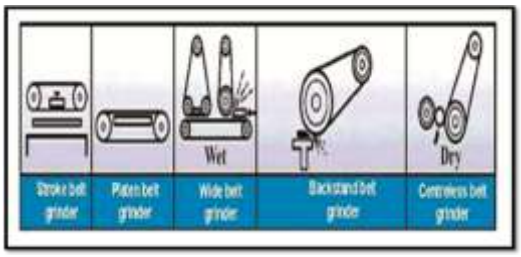

Figure: 3.3 Methods of Abrasive Belt Grinding.

4. WORKING

That type of grinding machine is generally used for polishing the small metallic component like washer. In that machine abrasive belt fitted on the two roller. The coupling is used for transmission of power from electric motor to the roller shaft. As the first roller rotated then second roller rotated with same speed because of abrasive belt wound over the surface. When we keep the any small part on abrasive belt & apply the pressure over the surface of the belt, then the small component polished. Because of that machine good quality of glassing also obtained for good look component. The abrasive belt is available in various sizes in the market. Belt grinding machine may be dry belt wet belt or combination belt. Belt grinding machine is used for heavy stock removal or for light polishing work depending upon the type of belt grade used.[3]

5. CONCLUSION

The study on belt grinding has highlighted the significance of belt parameters and machining parameters on the grinding performance. In this study the belt parameters such as bond, type of backing and flexibility are identified as new innovative factors which influences the belt grinding process. The degree of influence of machining parameters such as belt speed, contact area and pressure has shown significant relation with belt parameters. The observations have clearly demonstrated the distinctive differences between rigid grinding such as wheel grinding and flexible grinding such as belt grinding especially regarding the significance of grit size, belt speed and bond. The conclusions drawn from the study are presented in this chapter.
Resin over resin bond, low speed and higher contact area facilitates enhanced material removal, while relatively lower order grinding pressure is prone to ensure minimum belt wear and good finish. Thus optimizing for G-ratio is tough task in belt grinding. Among the backing, polyester facilitate ensures good grinding performance Finer grit and medium contact area with high belt speed facilitates enhanced material removal, while finer grit and higher contact area facilitates belt wear constrained grinding again belt grinding calls for parameter constrained optimization for achieving overall belt performance. Selection of grinding parameters is relatively material specific. While finer grit facilitates enhanced material removal irrespective of the work material being ground. Medium to higher speed and low to medium speed facilitates better belt performance. This is in contrast to rigid grinding (wheel grinding) practice.

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