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MEASURATION OF GRINDING WHEEL DECREASE

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¶A***bstract:*** *The grinding is important part of machining technology and inseparable part of this is a grinding wheel, too. Grinding wheel wearing is one from characteristic values of grinding process and its measuring is relatively complicated process. This article describes methods which are using or was developed or will input at FPTM*

Key words: *grinding, f grinding wheel loss, blade, microwave, laser*

1. INTRODUCTION

Grinding is very important finishing operation and allows getting high quality of surface. Grinding is used for large amount of worked pieces. Development of high performance grinding wheels or grinders allows spreading grinding into raw operation. Therefore grinding is focused in theory and research.

Grinding wheel is very important element of grinding process. Grinding wheel loss is one of the characteristic parameters and shows process, grinding wheel properties, grinded material, cutting properties etc. To get a value of grinding wheel loss is complicated and this article describes used to evaluate it and method used, researched or considered to use at FPTM.

At FPTM is nowadays used method called „shaving-blade method“. This method uses hardened steel tape – we use shaving blade and it named method. Next method uses microwaves and beside it we consider to buy laser equipment and use it for measurement of grinding wheel loss [1], [3], [4], [6].

2. SHAVING-BLADE METHOD

At FPTM, lab for grinding research is used method for measuring grinding wheel loss by hardened steel tape. This method is very simple and resources demanding, but is hard elaborated and it is workload for workers.

This method uses tree pieces – measured workpiece, grinding wheel and shaving blade. Precaution for method is simple – grinding wheel width must be greater than width of workpiece ($b_s > b_w$), see the fig. 1. After grinding is „trace“ on grinding wheel (fig. 2). From this we can take the information about grinding wheel loss. Hardened tape (shaving blade, wider than grinding wheel) is pushed against grinding wheel (fig. 3, 4) and we get negative „imprint“ – see fig. 5. This imprint is measured using microscope Jenawert.

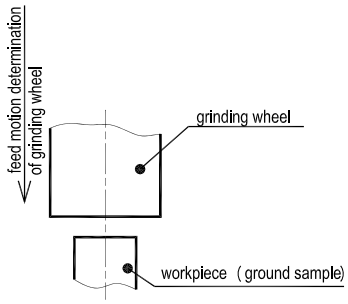

Fig. 1 *Grinding wheel and ground sample*

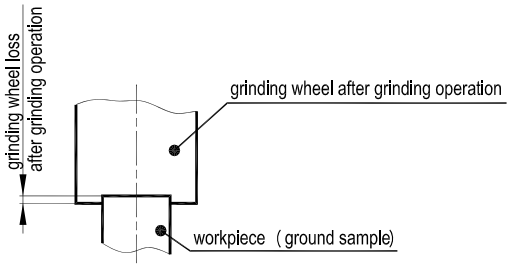

Fig. 2 *Schema of grinding wheel condition and ground sample after grinding operation*

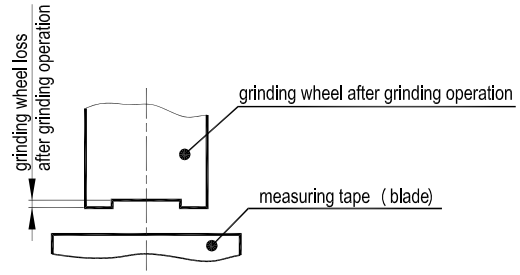

Fig. 3 *Measuring blade befor impress*

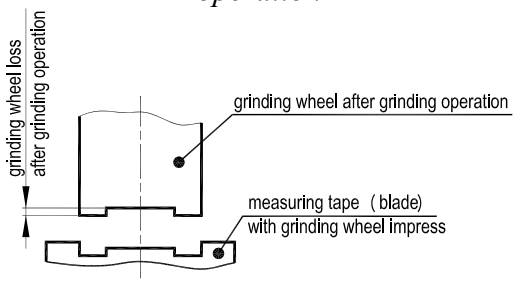

Fig. 4 *Schema of grinding wheel impress to the measuring tape and its plotting*

First, we need to know a distance A, and then we define half of this distance. After that we need to define two points, which are on the places after impress of grinding wheel. Theses points must be at the same distances (B) from half of distance A and should not be at boundaries (as can be seen on fig. 5). Grinding wheel loss is calculated via (1) where n is number of grinding cycles, other values are distances from fig. 5.

$$\Delta r_s = \frac{C + D}{2 \cdot n} \tag{1}$$

At FPTM we mainly use grinding wheel with high abrasive resistance (C or D are thousandth or hundredth of millimeter), so we proceed measuring after four grinding cycles. This method is very accurate, even in situation, when blade is not accurate fastened in jig (see fig. 6.

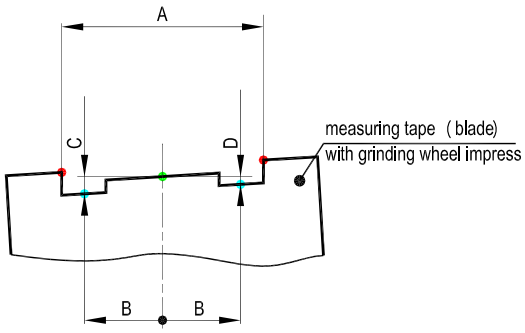

Fig. 6 *Schema of grinding wheel impress in case, that the blade isn't fixed well*

This method is quite simple, but time consumed and tiring for worker. Therefore at FPTM we look for another solution to replace shaving-blade method. One idea is next method - microwave.

3. MEASURING OF GRINDING WHEEL LOSS BY MICROWAVES

In some cases we can use microwaves to measure wheel loss, method microwaves' bridge. microwaves have one big advantage – it can be used on running machine. And we assume that value of wheel loss is in single μm.

Microwaves are part of electromagnetic radiation, characterized by frequency f (300MHz – 300 GHz) and wavelength λ (100 – 1mm in vacuum).

At FPTM we use method microwave bridge in bridging T shape (fig. 7). This method is used to compare of electromagnetic properties based on reflection. We created microwave measuring equipment.

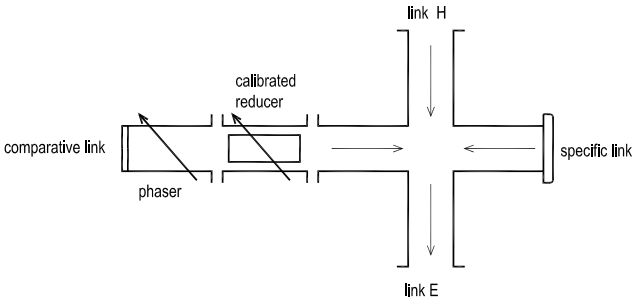

Fig. 7 *Bridge T*

Fundamental of method is to split microwaves from source (H) into measuring and comparing branch. In both branches are reflections and sensor gets two signals. One is reflection from measured element and second is influenced by control elements - paralleling apparatus, calibrated attenuator.

If reflected microwaves are on different intensity, input in output measuring branch is signal responding difference between those two reflected signals. At the beginning can reach zero difference (bridge alignment). Then grinding wheel loss changes reflection in measuring branch and in output branch appears non zero signal. Using additional equipment we cat value of signal convert into value of grinding wheel loss.

Experiments are taken on machine BU16 in FPTM labs. Until now, experiments are successful and research of this method is supposed to be continued [2], [7], [8], [9].

4. MEASUREMENT OF GRINDING WHEEL LOSS BY LASER

Another way how to measure grinding wheel loss is measuring distance using laser equipment. Here is intended to use equipment for measuring distances or dimensions. At FPTM we consider to purchase such equipment. It may save a lot of work and time during experiments at FPTM.

Considered laser meters use triangular measuring method. This method (fig. 8) is generally used to determine distance of measured object from the spectator. Condition of this method is to „observe" object from two points (A, B – we have to know their distance d) and measure angle to measured object (α, β). From this data we can calculate distance C – D (y). Optical methods based on triangulation are the most used nowadays.

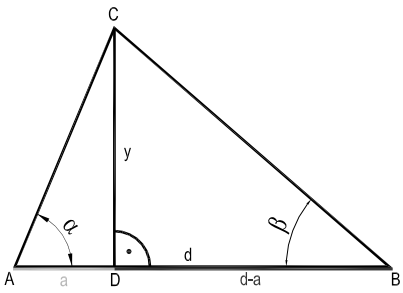

Fig. 8 *Triangular method*

Laser meters uses light source, scanner and together with illuminated point creates triangular triangle (fig. 9). Connecting line between light source and scanner is named triangular base. Angle between triangular base and laser ray from source is constant, but angle on scanner side is defined by various position of illuminated point. Knowing triangular base we can calculate z-axis coordinate of illuminated point on surface of measured object.

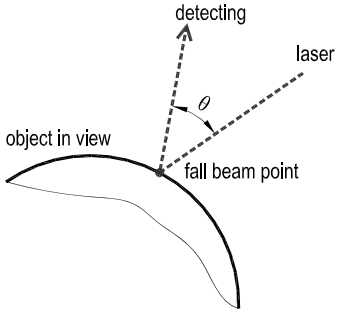

Fig. 9 *Principe of measuring tool work*

At FPTM we currently evaluate some laser meters from those that can be used for grinding wheel loss. At the present we choose meter made by KEYENCE and from its range LC series. Despite others, this uses separate light source (transmitter) and scanner (receiver). It brings much more accuracy. Meter uses visible ray (diameter 12 micrometers) and it makes focusing very easy. Meters of LS series uses sampling frequency of 50Hz enabling to measure objects even rotating at high speed and its eccentricity. And measured distance can be up to 30mm, therefore we can measure objects in case where is impossible to place equipment close enough. It can indicate cracks and it's deep. This property allows using this meter use for measurement of grinding wheel loss. The same meter uses Technical University in Liberec and we consult usage, advantages and disadvantages of it. [5], [10].

4. CONCLUSION

As described, measurement of grinding wheel loss is complicated and laborious and methods are different. In spite of that we should engage in it. Volumes of cut material and grinding wheel loss are important figures in manufacturing and rate grinding wheel or whole grinding process. As long as we set up easy method applicable on grinders we can expect big savings. Then wheel dressing can be proceeding when needed not regularly.

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