REVIEW ON DRESSING OPERATION OF GRINDING WHEEL

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Abstract*—Grinding is an operation applied in almost every type of manufacturing process. This paper presents a summary of numbers of researches done by the different authors on the dressing and grinding operations. We are moving towards more comfortable and time saving method, for this reason many engineers are contributing their innovation for several things to make Simple, Easy Handling and Save Time Consumption for Production. Grinding technologies represent a critical step in the production of high added-value and high precision parts for strategic industrial sectors such as aerospace, automotive, biomedical, and wind generation. Dressing is that the technique used to resharpering of Grinding Wheel which result into an increment in Productivity & optimization of time with a High surface finish of a workpiece by Grinding. Grinding could be a machining process that utilize abrasives for the removal of fabric. The sharp edges of abrasive grains act as cutting implement that take away material within the form of powder or fine chips.This method provides a fast review on varied grinding dressing technique and parameters that influences the dressing operation. Grinding process is very quick process but simultaneously the dressing also important for fine grinding that's why some different processes are used for Dressing of grinding wheel. like Electrolytic In-Process Dressing (ELID), Diamond Tool Dressing (DTD), Laser Tool Dressing (LTD), etc.

***Keywords--* Abrasive, Dressing, Diamond tool, ELID, Grinding, Laser Tool Dressing.**

I. Introduction

Grinding could be a machining method that utilizes abrasives for the removal of fabric. The sharp edges of abrasive grains act as cutting implement that take away material within the type of largely powder or very fine chips. The abrasive grains or grit (like carbide (SiC), corundum ($Al2O3$) or fine diamond grains) are utilized in the form of a wheel.[2-3] The grit is present along side binder (metal, organic compound or vitrified), a cloth that bonds the abrasive particles along and imparts the mixture, the form of a wheel. once grinding operation is performed the edges of grains become blunt that reduces the cutting performance of the wheel. The wheel additionally tends to be loaded with material that's being machined. so as to use the wheel once more for machining satisfactorily, the wheel should be ready to cut as before. this can be accomplished by the applying of further procedures like dressing and truing. [5-7]

Dressing is associate operation performed on the wheel with an aim to revive the cutting ability. The basic principle for dressing is that the generation and exposure of the new cutting edges on the surface of the wheel. It is achieved by fracturing the prevailing abrasive grains and allowing desired protrusion of abrasive particles on the surface. The operation additionally unloads the grinding wheel i.e. removes work piece material that's embedded on wheel surface when the grinding operation. On performing this operation, the wheel will machine once more with higher feed and in-feed (depth of cut) rate, which allows to conclude the machining in less time however with higher accuracy. Dressing is needed at regular intervals to maintain the required grain edge sharpness and therefore the grain protrusion Dressing could be a method of learning the grinding wheel surface so as to reshape the wheel once it's lost its form through wear. There are numerous varieties of dressing techniques and also the development and improvement in these techniques area unit happening. The grinding could be a machining method specially for finishing operation in exhausting materials so as to get low surface roughness and tight tolerances .It is needed to select the tool rigorously for the dressing of grinding wheel .In grinding method roughness is completely depend upon sharpness of the abrasive grains.[1-5]

II. Laterature Review

Li Xue et al Studied the online process monitoring of dressing will ensure the quality of grinding wheel and will achieve the reproducible surface finish. The acoustic emission sensors are used for the monitoring surface finish. With the help of this sensor it became possible to detect undesired grinding wheel conditions ,such as an out of roundness wheel and wheel contour errors. Experimental results indicates that AE signal can be effectively use to identify faults that might occur during dressing. Monitoring of dressing parameters results in a more consistent surface roughness in consequent grinding operation . [2]

J. Kundrak et al Studied that the evaluation of abrasive ability of diamond using indirect criterion the specific power of grinding, this easy to measure parameter is a definite criterion of abrasive ability of diamond dressers. It also reported that rough dressing shocks be fulfilled at low speeds and final dressing should be performed at high rotating speeds of grinding wheel . [3]

A. Sudiavso et al studied that the electrical dressing method is used for over coming the limitations of the conventional dressing methods available in relation to super abrasive wheel because of hardness of its abrasive grains and durability of its bonding material . It also results in better surface finish by suitable maintaining the process conditions. [4]

H. Ohmori et al studied that an Ultra precision grinding of structural ceramics by electrolytic in process dressing (ELID) grinding suggested the ELID technique which uses a metal bonded grinding wheel that is electrolytically dressed during the grinding process for continuous protrudent abrasive from super abrasive wheels. Due to the use of ELID procedure, a mirror finish surface grinding by using micro grit cast iron fiber is possible. This technology has wide applications in case of optical and semiconductor industry. [5]

Manojkumar Sinha et al studied that An investigation into selection of optimum dressing parameters based on grinding wheel grit size studied about the dressing parameters selection during grinding process. They have studied about dressing depth and lead for a 60 grit size alumina grinding wheels. They have concluded that specific grinding forces dresses with increase in dressing lead surface roughness totally depends upon dressing lead. Smaller lead lower the roughness. [6]

Eduard Carlos Bianchi et at studied that CBN (cubic boron nitride) grinding wheels with the purpose of identifying the state of art in abrasive machining. They have analysed that ractical wear values indicated the superior performance of vitrified CBN grinding wheel when compared to resin bond one. The most strongly marked difference were found in analysis of G ratio values, which demonstrated that the performance of CBN grinding wheel with high performance resin bond was up to 30 times better times better than alumina tool. [7]

J. Pfaff et al studied about an alternative process for dressing electroplated CBN (cubic boron nitride) grinding wheels using ultrashort pulsed laser. This process proves to be an efficient method for preparation of CBN grinding tools. Due to the LTD tool macro& microscopic level different exhibition has became possible. The bearing area of convectional tool, however, follows a downward trend, diminishing 25% over the next 4500mm^3/mm. this downward trend suggests a faster wear of the conventionally dressed CBN grains. The 59% lower bearing area of conventional tool compared to LTD tools is in accordance with the microscopic analysis of the grains. LTD tool exhibit a 60% area higher bearing area than conventionally processed tools. The LTD process leads to a better surface finish, on average 13% lower Ra & 18% lower Rz values. [8]

B. Kersschot et al studied on an Electrolytic In process Dressing (ELID) of a grinding wheel and also explains During the process how the total resistance of a grinding wheel changes. He do the experiment on the wheel has a cast iron bonding meshed with abrasives of 46 µm & The electrolyte is a 2% dilution of Noritake Cool CEM. [9]

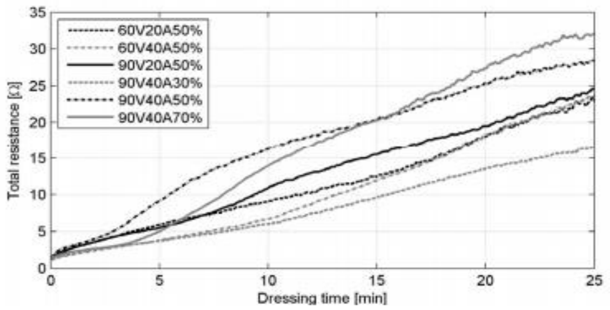

Fig. No. 1 Resistance vs Dressing Time at Speed of 10 m/s [9]

The Helmholtz representation of a double layer can be used to model the passivation layer growth during the dressing of a metal-bonded grinding wheel. The dressing/passivation speed is faster in the case of higher power outputs, bigger grit sizes and lower wheel speeds. This means that lower wheel speeds are favorable during pre-dressing.

Albert J. Shih et al studied that dressing & truing force and the particle wear mechanism and diamond blade tools are are used to generate precise and intricate form on rotating various bond silicon carbide grinding wheel from his results:

(A) for rod Diameter the at high speed of grinding wheel during dressing i.e. 127mm/min (transverse speed). The required grinding force is less i.e. 10 N/mm as compare to at a transverse speed 13 mm/min required force is 12 N/mm At a constant feed 10µm. [10]

(B) For Particle Diamond as compared to rod diamond tool the particle diamond tool required half or 2/3 time of load for this dressing operation i.e. at a transverse speed 127 mm/min. dressing force required is 5 N/mm and at a transverse speed 13 mm/min the force required for dressing is 6 N/mm. [10]

Genyu Chen et al studied that on dressing of grinding wheel by the physical process of multiples laser ablation of bronze-diamond grinding wheel. the results are from his analysis are affects and Phase explosion, plasma shielding effects and energy accumulation under the phase interval from his experiments results are comes out under indicated conditions. The laser power intensity of 1.68×10^{8}W/cm^2 Could only perform dressing of the grinding wheel and the laser power intensity 2.519×10^{8}W/cm^2 merged the truing and dressing of the grinding wheel and the laser power intensity of 3.359×10^{8}W/cm^2 realized ultra depth dressing but seriously affected the projection height of grits from the bond and their grinding performance. the lesser intensity increased then roughness decreases of grinding wheel. [11]

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III. Suggested Mechanism

The sliding dovetail is a method of joining two boards at right angles, where the intersection occurs within the field of one of the boards, that is not at the end. This joint provides the interlocking strength of a dovetail. Sliding dovetails are assembled by sliding the tail into the socket. It is common to slightly taper the socket, making it slightly tighter towards the rear of the joint, so that the two components can be slidtogether easily but the joint becomes tighter as the finished position is reached. Another method to implement a tapered sliding dovetail would be to taper the tail instead of the socket. When used in drawer construction, a "stopped sliding dovetail" that doesn't extend across the full width of the board is sometimes referred to as a "French dovetail. [14]

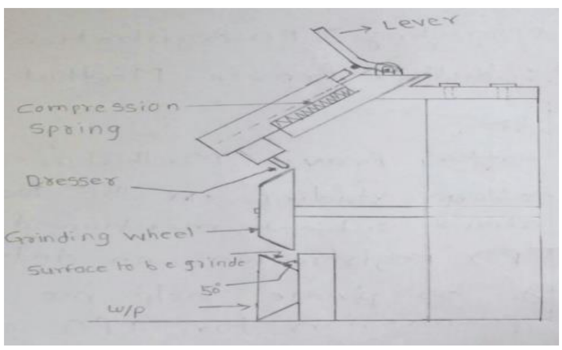

Fig. No.02 Sliding of Diamond Tool by using Dovetail sliding joint

IV. Future Scope

This review is to be useful for suggestion of mechanism for grinding wheel dressing. In this review we ha have suggested a mechanisms that is Dressing fixture using Dovetail sliding joint with a diamond dressing tool. this mechanism will be work in process i.e. Dressing of Grinding wheel with Grinding of Workpiece. Due to this we are optimize the time required to overall process i.e. Grinding and Dressing which are now doing by using separate mechanism or by using costly or time consuming processes i.e. ELID, LTD, etc.. That's why this mechanism also reduces the cost of process and our aim is to be achieve i.e. optimization of time and cost with simple way.

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References

[1] U. M. Shrivastava. 2013 "Review of Dressing & Truing Operations For Grinding Wheels", IJEST, Vol. 5 pp8-19.

[2] Xue Li., Naghdy F. & Cook C., "Monitoring of wheel dressing operations for precision grinding", FIEEE International Conference on Industrial Technology, 11-14 December 2002, 2, 1296-1299.

[3] J. Kundrak, V. Fadorovich, A. P. Markopoulos. 2014 "Improvements of The Dressing Process of Super Abrasive Diamond Grinding Wheel" Manufacturing Technology, vol.14, pp.545-554.

[4] A. Sudiarso, J. Atkinson. 2008 "In-Process Electical Dressing of Metal-Bonded Diamond Grinding Wheels" Engineering Letters, Vol.16:3.

[5] H. Ohmori, I. Dakahashi, B. P. Bandy Opadhyay. 1996 "Ultra-Precision Grinding of Structural Ceramics By Electrolytic In-Process Dressing (ELID) Grinding" JMPT (Elsevier) Vol. 57, pp 272-277.

[6] Manojkumar sinha, Dinesh Sctti, Sudarsan Ghosh, P. Venkateswar Rao. 2014 "An Investigation Into Selection of Optimum Dressing Parameters Based On Grinding Wheel Grit Size" AIMTDR. pp 146-(1-6).

[7] Eduardo Carlos Bianchi, P. R. De Aguiar, R. D. Monici.2003 "Analysis of The Performance of Superabrassive & Alumina Grinding Wheels With Different Bonds & Machining Conditions " Materials Research, Vol.6, No.2, pp 239-246.

[8] Pfaff J., Warhanek M., Huber S.. 2016 "Laser Touch Dressing of Electoplated CBN Grinding Tools." ELSEVIER Procedia CIRPA 46(2016). pp 272-275.

[9] A. J. Shih, W. I. Clark, J. L. Akemon. 2001 "Wear Of The Blade Diamond Tools In Truing Vitreous Bond Grinding Wheels Part II. Truing And Grinding Forces And Wear Mechanism" ElSEVIER WEAR Vol. 250 (2001), pp 593-603.

[10] B. Kersschot, J. Qian, D. Reynaerts. 2013 "On The Dressing Behavior In ELID-Grinding", Elsevier Procedia CIRT 6 (2013), pp 632-637.

[11] G. Chen, S. Cai, C. Zhou. 2015 " On The Laser Driven Integrated Dressing And Truing Of Bronze Bonded Grinding Wheels" ELSEVIER Diamond & Related Materials, Vol.60 (2015), pp 99–110.

[12] A. Golabczak, “Selected problems of electrochemical and electrodischarge dressing of grinding wheels with metal bond,” in Proceeding of the ISEM XIII, vol. II, Bilbao, 2001, pp. 851-868.

[13] Babu, N. R., Radhakrishnan, V. and Murti, Y. V. G. S., “Investigation on Laser Dressing of Grinding Wheels —Part I: PreliminaryStudy,” J. Eng. Ind., Trans.ASME, Vol. 111, 1989, pp.244–252.

[14] Hoffmeister, H. W. and Timmer, J. H., “Laser Conditioning of Superabrasive Grinding Wheels,” Industrial Diamond Review. Vol. 60, No. 7, 2000, pp.209–218.

[15] Hosokawa, A., Ueda, T., Yunoki, T., “Laser dressing of metal bonded diamond wheel” CIRP Annals-Manufacturing Technology. 2006; 55(1): pp 329-332.

[16] Rabiey, M., Walter, C., Kuster, F., Stirnimann, J., Pude, F., Wegener, K., “Dressing of Hybrid Bond CBN Wheels Using Short-Pulse Fiber Laser.” Strojniški vestnik - Journal of Mechanical Engineering, North America, 58, jul. 2012.

[17] Rhoney, B. K. (2001). Cylindrical Wire Electrical Discharge Truing of Metal Bond Diamond Grinding Wheels. Schöpf, M., Electro Chemical Discharge Machining (ECDM). Neue Möglichkeiten zum Abrichten metallgebundener Diamantschleifscheiben von Martin Schöpf. (2001).

[18] W. Brian Rowe "Principle Of Modern Grinding Technology" (Second Edition), 2014, Pages 63-82.