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# Comparison of Effect of process on surface roughness of Copper and Mild Steel using Compact Lapping Machine

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***Abstract:*** *Lapping is the precise removal of material from a work piece (or specimen) to achieve a desired dimension, surface finish, or shape. Lapping material has been used on a wide variety of materials and applications, including metals, glasses, optics, semiconductors, and ceramics. Because of the precision and control with which material can be removed, lapping techniques are advantageous. The main outcome of the paper is chacking the outcome of Ra value of semi automatic*

***Key Words:*** *Production, Méthodologies, Development, Surface lapping.*

## 1. INTRODUCTION:

The most powerful and smartest species on earth, "Man," is working in science, engineering, and other professions to make life on Earth easier for individuals who have been a part of it for millions of years. With the aid of Nature, Man has discovered a variety of elements, including metals, non-metals, ceramics, and other parts or elements found in Nature. During the discovery of these elements, as a result of working towards it and discovering it over a long period of time, Man began performing the work in an accurate behaviour, manner, or skills. Man began to work in Accuracy and Precision. Different invention of the elements, numerous machining techniques such as welding, drilling, grinding, cutting, milling, and so on were introduced to the workplace[1-3]. Precision and accuracy were prioritised when carrying out these activities. Accuracy and precision are carried away or utilised in every field to achieve greater results in today modernised environment. The project introduces the lapping process, its history, types, advantages, applications, and application in the present world. Lapping is done on metals, non-metals, and ceramics to get a super polish as well as great accuracy and precision. As the initiative is intended to improve small-scale industries and reduce staff workload.

### *Concept design*

The primary idea behind this project is to execute a lapping procedure on metals, non-metals, ceramics, and other materials after grinding or cutting to remove marks, burns, or cuts. Lapping is used to achieve a high surface finish/super finish as well as maximum accuracy and precision. Lapping is done in this project with the help of abrasive particles and by exerting external force with the self-weight of the product or part. The most significant concept of the project is to deliver a decent machine at a low cost to small scale enterprises in order to reduce their work and effort.

## 2. LITERATURE REVIEW :

Mr. Pratheesh Kumar [4] discussed process in which material is removed owing to relative motion between the work material, loose abrasive grains, and the machine plate that laps. This method is used to achieve finer surfaces and tighter fitting, repair of minor flaws, and maintaining tight tolerances. Despite the fact that a strong underlying science–foundation exists in terms of physics, mechanics, and thermal effects, lapping has been seen as an art rather than a science. As a result, investigating lapping at a fundamental level will aid in its application. This study examines the impact of various process parameters on material removal rate and surface finish. This is accomplished by a series of tests in which the process parameters are varied and the material removal rate and surface roughness are calculated. The final stage is to select the best combination of process parameters for determining the material removal rate and surface finish. This is accomplished by a series of tests in which the process parameters are varied and the material removal rate and surface roughness are calculated. The final stage is to select the best combination of process parameters for determining the material removal rate and surface finish. The surface finish created on the component is determined by a variety of elements such as abrasive concentration, lapping time, and so on. As a result, for a good surface finish, these elements must be efficiently regulated. When it comes to surface finish, it is crucial. Addressing difficulties such as friction, lubrication, and wear it has a significant impact on thermal or electrical applications, electrical resistance, noise and vibration management, and dimensional stability tolerance, etc. The surface finish obtained via lapping is determined by the rate of material removal. Normally, as the MRR increases, the surface roughness increases.

S. M. Fulmaliet [5]discussed micro finishing technique used to achieve a mirror-like surface finish on a meting component. It gives a lot of strength to the constructed joint. Lapping is widely employed in the production of optical mirrors and lenses, ceramics, hard disc drives, semi-conductor wafers, valve seats, ball bearings, and a variety of other items. Several aspects must be considered during the lapping process. Several aspects must be considered during the lapping process. This includes factors such as machine type, lap plate surface condition, lap plate speed, abrasive type, carrier fluid type, slurry concentration, slurry flow rate, abrasive size and shape, lap plate material, rigidity of the lap plate, applied force on the work piece, time of operation, and duration between two consecutive instances of applying fresh abrasive. The purpose of this article is to investigate the current working conditions of lapping machines in the valve sector. It will go over the effects of abrasive particles, working speed, surface roughness, and other variables. The challenges they are experiencing during valve reconditioning due to lapping will be explained. The proposed model includes the current setup as well as the adjustments that are required in this model. The research presented above, as well as the proposed model, may be used in the lapping of valve components. The model will be portable and, to some extent, will reduce the time required to set up for lapping. The study demonstrates the significance of lapping operations in the valve sector. It shows the abrasive size and type used for valve lapping. This proposed model will be the least expensive when compared to the available lapping machines. It will prove to be a cost-effective model. This machine requires only one labourer to operate, and it can be operated by less competent employees.

R. B. Chadge [6] Studied the lapping process, which is distinguished by its low speed, air mass, and material removal rate. This process is used to achieve finer surfaces and closer fitting, to rectify minor flaws, and to maintain tight tolerances. The processes of surface development and removal rate are strongly impacted by the movement style of the individual grains among the lapping abrasive throughout the lapping procedure.

## 3. LAPPING PROCESS :

### *A. Lapping process*

Lapping is the process of removing material to create a smooth, flat, and polished surface. Lapping is essentially an abrasive process in which loose abrasives operate as cutting points and find transitory support from the lap abrading action is done by very small particles kept in a vehicle [7-8]. Material removal in lapping typically varies between 0.003 and 0.03mm. Lapping is a procedure used to create dimensionally correct specimens with tight tolerances (generally less than 2.5 um). The lapping plate will normally rotate at a low speed of 80rpm with a mid-range abrasive particle (5-20um). Lapping removes sawing or grinding subsurface damage and produces the required thickness and flatness. Lapping can be done manually or by machine. Hand lapping uses abrasive powder as the lapping medium, whereas machine lapping is divided into two types: free abrasive lapping and fixed abrasive lapping. When abrasive slurry is put directly to a lapping plate, it is referred to as free abrasive [9]. This is possibly the most precise way for obtaining specimens while causing the least amount of damage. Because of the stiff lapping surface that may be adjusted to suit a certain material, free

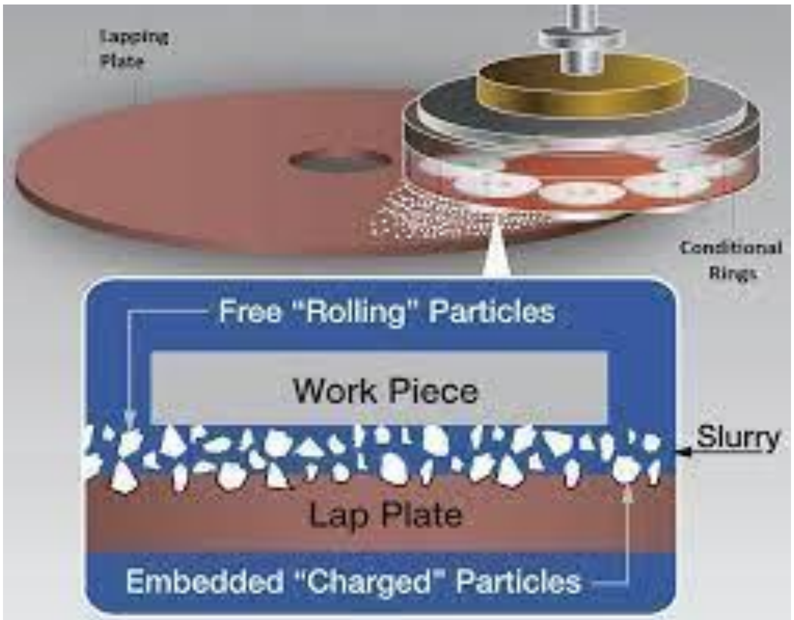


Fig. 3.1 Basic working principal of Lapping Machine

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abrasive lapping is precise. A softer substance for the lap is "charged" with the abrasive in fixed abrasive lapping. When an abrasive particle is attached to a substrate, as with abrasive lapping films and Sic sheets, this is referred to as fixed abrasive lapping. Abrasive lapping films are made up of different particles that are attached to a thin, consistent polyester substrate and can provide a highly smooth surface.

## 4. DESIGN OF MACHINE COMPNENTS :

### *A. Frame*

The frame is composed of Mild Steel Angle with dimensions of 25mmx25mmx5mm and Mild Steel Square tube with dimensions of 15.5mmx15.5mmx3mm. The frame is strong because it must withstand the vibration and dampening of the gear box as well as its weight.

Fig. 4.1 Basic frame for lapping machine structure

### *B. Work Table*

The Table is circular in shape and made of Cast Iron. It is the main part of this machine to perform lapping operation Work piece is mounted on the table. It rotates about the centre due to gear box Grooves are provided on face on table which are helpful for lapping process to increase the friction of lapping paste on work surface.

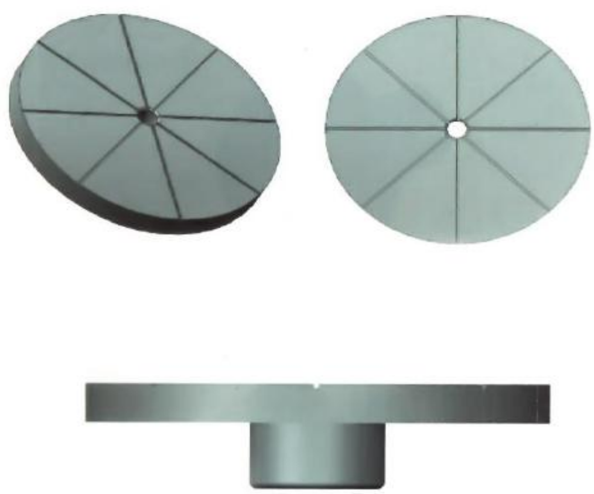

Fig. 4.2 Different Views of Workpiece

### *C. TABLE LOADING COMPONENT / HUB*

This is placed on output shall of gearbox and below the table, table is clamped on this part. Upper side of this part is made in such a way that it can fit on in table due to which table becomes concentric to this part. Lower part is machined or bored such a way that its output shaft is press fitted in this lower side of loading component. Ultimately the table rotates concentric to shaft. This part is made from mild steel and designed based on the sructural strength and bending strength [10]. The function of this part is to support the table and keep the table in always in balancing condition This part is made from mild steel. The function of this part is to support the table and keep the table in always in balancing condition.

Fig. 4.3 Different views of table loading component

**5. TEST ON MACHINE :**

On the Lapping machine, samples with various features and employing various modifications were examined. Time, materials, dead weight, and various lapped abrasives are all variables. With the help of the images and specimen information below, it is possible to see the differences between Hand Lapped Specimens and Specimens tested with variations. The technique uses Silicon Carbide (Medium Particles) as the lapping abrasive, and each specimen's dead weight is 250 gms. The two distinct samples are made in the manner depicted in figs. 5.1 and 5.2. The sample in Figure 5.1 is prepared with a 2-minute lapping period, while the sample for the second scenario in Figure 5.2 is prepared with a 4-minute lapping time.

The test is carried out on the surface roughness machine and it gives results as 2.39 micron for before lapping (rough side) and 2.02 for the after lapping side( smooth side) for lapping time is 2 minute. While for 4 minute lapping time the values are shifted to 2.16 and 1.39 micron respectively. The rough side is prepared by the hand operation shile smooth side is prepared from the machine that is designed.


Fig. 5. 1 Copper Specimen 1 with lapping time 2 minutes


Fig. 5. 2 Copper Specimen 2 with lapping time 4 minutes lapping processing time

The similar study is carried out on the Mild Steel and the results obtained in the same pattern. For the test we used lapping time 2 minute and 4 minutes and other parameters are remains same. The results are as shown in the fig. 5.3


Fig. 5.3 Mild Steel specimen with 2 minute and 4 minute lapping processing time

The surface roughness values of both the cases are comparatively good as in first case 1.89 micron for first case while 1.49 micron for smooth case while 1.11 micron for rough side and 1.07 for smooth side respectively.

**6. CONCLUSION :**

In light of the findings, we concluded that machine lapping is more convenient than hand lapping. Our machine is semi-automatic, which means that the task only needs to be loaded once, and the rest of the procedure is automated. Nevertheless, in Hand. The specimens must be lapped with the hand utilising human efforts. Our machine's production decreases human efforts, as well as the amount of time and man power required.

The results shows the difference between the machine lapped product and the hand lapped product. Both the specimens are lapped for the same time and same surface but the Machine lapping Specimen shows more difference in Ra value then the hand lapped specimen, which means that use of this semi-automatic machine in small scale industry may be preferable. There are other results of variation done on the lapping machine, its environment and time for testing the machines, which shows the machine ability in various conditions.

**REFERENCES :**

1. Khot R. S. and Prasanna Rajendra Kadam (2021) Structural behavior of fillet weld joint for bimetallic curved plate using finite Element Analysis (FEA) 6th International Conference on Advanced Research in Arts,

Sciences, Engineering and Technology (ICARASET- 2021) ISBN Number: 978-93-90956-53-1 Page no. 23-28

2. Khot Rahul S, T. Venkateshwara Rao, Harshad Natu, H.N. Girish, Tadashi Ishigaki, Puttaswamy Madhusudan (2021) An Investigation on Laser Welding Parameters on the Strength of TRIP Steel Strojniški vestnik - Journal of Mechanical Engineering 67(2021)1-2, 45-52
3. Khot Rahul, S., Venkateswara Rao, T. (2020). Investigation of mechanical behaviour of laser welded butt joint of transformed induced plasticity (TRIP) steel with effect laser incident angle. International Journal of Engineering Research and Technology, vol. 13, no. 11, p. 3398-3403, DOI:10.37624/ IJERT/13.11.2020.3398-3403.
4. M. R. Pratheesh Kumaret (2013) "Optimization of Process Parameters In Lapping of Stainless Steel", International Journal of Engineering Research & Technology (IJERT), Vol. 2 Issue 9, September - 2013.
5. S. M. Fulmali (2012) "Need of Lapping Machine for Valve Component: A Case Study", International Journal of Modern Engineering Research(IJMER), Vol. 2, Issue. 6, Nov.-Dec. 2012 pp-4609-4612.
6. Workshop technology by S K Hajra Choudhury (The 10 h Edition, 1985).
7. Owat Sunanta (2002) "flat surface lapping: process modeling in an intelligent, Environment", University of Pittsburgh.
8. Y. V. V. Satyanarayana Murthy (2011), Combustion Analysis and Knock Detection in Single Cylinder DI-Diesel Engine Using Vibration Signature Analysis, International Journal of Engineering Science and Technology (IJEST),Visakhapatnam, pp. 10-16.
9. Bhargav Khanpara, Pankaj Rathod, (2017), A Review on HardSurface Coatings Applied Using Stellite Hard facing Techniques, International Journal of Engineering Technology, Management and Applied Scienc es, India, pp.132-139.
10. V.B. Bhandari (2010) Design of Machine Elements Tata McGraw-Hill.