International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 03 | Mar 2020 www.irjet.net p-ISSN: 2395-0072

# TRIBOLOGICAL CHARACTERISTICS OF AL-SIC-MOS$_2$ CYLINDRICAL POWDER PREFORMS UNDER DRY ATMOSPHERIC CONDITIONS

**Bysani Yuvaraj[1], Yerrapragada Y Sriram[2], Jayanth Ivvala[3], Gutha Radha Krishna[4], Bodduluru Sumanth[5]**

*[1]bysani Yuvaraj, 1-3/28-10, Yaddanapudi Vari Street, Vidhyadharapuram, Vijayawada, 520012*
*[2]y Y Sriram, 80-17-88/9, A V A Road, Kokabhaskaramma Nagar, Rajamahendravaram, 533106*
*[3] Jayanth Ivvala Professor, Dept. Of Mechanical Engineering, K L University, Andhra Pradesh, India*

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**Abstract -** *Wear characteristics of AL-SIC-MoS$_2$ powder pre-forms are to be investigated in this work. Al-SiC-MoS$_2$ pre-forms of one composition are to be tested, considering two compacting pressures and one sintering temperature. The wear tests are to be conducted in a purpose built pin-on-disc apparatus against silicon carbide abrasive paper under multi-pass conditions at room temperature. Wear studies are to be conducted under various testing conditions such as applied load, Constant sliding velocity, Time in seconds and abrasive grit number. The wear would be measured by means of loss in weight. Relationship between the weight loss and applied load was established.*

***Keywords**:* Wear, Stick slip, wear track radius and applied load

## 1. INTRODUCTION

Powder metallurgy is the process of blending fine powdered materials, pressing them into a desired shape or form (compacting), and then heating the compressed material in a controlled atmosphere to bond the material (sintering). The powder metallurgy process generally consists of four basic steps: (1) powder manufacture, (2) powder blending, (3) compacting, (4)sintering. Compacting is generally performed at room temperature, and the elevated-temperature process of sintering is usually conducted at atmospheric pressure. Optional secondary processing often follows to obtain special properties or enhanced precision.

Materials used for the specimen

- Aluminum
- Silicon carbide
- Molybdenum di sulphide

### 1.1 ALUMINIUM

Aluminum is the third most abundant element (after oxygen and silicon), and the most abundant metal, within the Earth's crust. It makes up about 8% by weight of the Earth's solid surface. Aluminum metal is too reactive chemically to occur natively. Instead, it is found combined in over 270 different minerals. The chief ore of aluminum is bauxite.

### 1.2 SILICON CARBIDE

**Silicon carbide** (**SiC**), also known as **carborundum**, is a compound of silicon and carbon with chemical formula SiC. It occurs in nature as the ultimate rare mineral moissanite. Silicon carbide powder has been mass-produced since 1893 for use as an abrasive. Grains of silicon carbide can be mixed together by sintering to form very hard ceramics which are widely used in applications requiring high tolerance, such as car brakes, car clutches and ceramic plates in bulletproof vests. Large single crystals of silicon carbide can be grown by the Lely method; they can be cut into gems known as synthetic moissanite. Silicon carbide with high surface area can be produced from $SiO_2$ contained in plant material.

**STRUCTURE AND PROPERTIES**

Silicon carbide exists in about 250 crystalline forms. The polymorphism of SiC is characterized by a large family of similar crystalline structures called polytypes. They are dissimilar of the same chemical compound that are alike in two dimensions and differ in the third. Thus, they can be viewed as layers arranged in a certain order.

Alpha silicon carbide (α-SiC) is the most familiar encountered polymorph; it is formed at temperatures greater than 1700 °C and has a hexagonal crystal structure (similar to Wurtzite). The beta modification (β-SiC), with a zinc blende crystal structure (similar to diamond), is formed at temperatures below 1700 °C. Until recently, the beta form has had relatively few industrial uses, although there is now growing interest in its use as a support.

## 1.3 TRIBOLOGY

Wear word refers to loss in dimension (plastic deformation) if there is a contact between two sliding surfaces. However, plastic deformation such as yield stress is eliminated from the wear definition if it doesn't include a relative sliding motion and contact with another surface despite the possibility for material removal, as a result it then lacks the relative sliding action of another surface. The impact wear could be a short sliding motion where two bodies get in contact for short time interval. Wear testing is a method for evaluating erosion or sideways ejection of material from its "derivative" and original position on a solid surface performed by the action of another surface. Materials behave dissimilar in friction state, so it may be important to perform mechanical tests which replicate the condition the material will experience in actual use. Wear tests of the selected alloy is a unfavourable parameter for determining the quality of these materials. The loads and forces acting on these materials while in service are compactive in nature and their ability to resist such loads and forces without failure is a measure of their dependence. A friction coefficient, μ, is defined as a ratio of the force that withstand sliding to the normal force. A tribometer is a device used to measure friction coefficients. While there is no standard tribometer test, experimental setups generally use similar design philosophies. This results in about uniform pressure distribution within the sample. Upon sliding, the frictional and normal forces are measured or conclude at the specimen simultaneously A detailed unreliable analysis of the measurement of friction coefficient on a similar pin-on-flat tribometer was done by Schmitz and illustrates the metrology challenges linked with such a seemingly simple measurement.

## 1.4 TYPES OF WEAR

Wear is generally divided into five major categories:

(1) Adhesion

(2) Abrasion

(3) Surface fatigue

(4) Erosion

(5) Corrosion

### 1.5 LITERATURE SURVEY

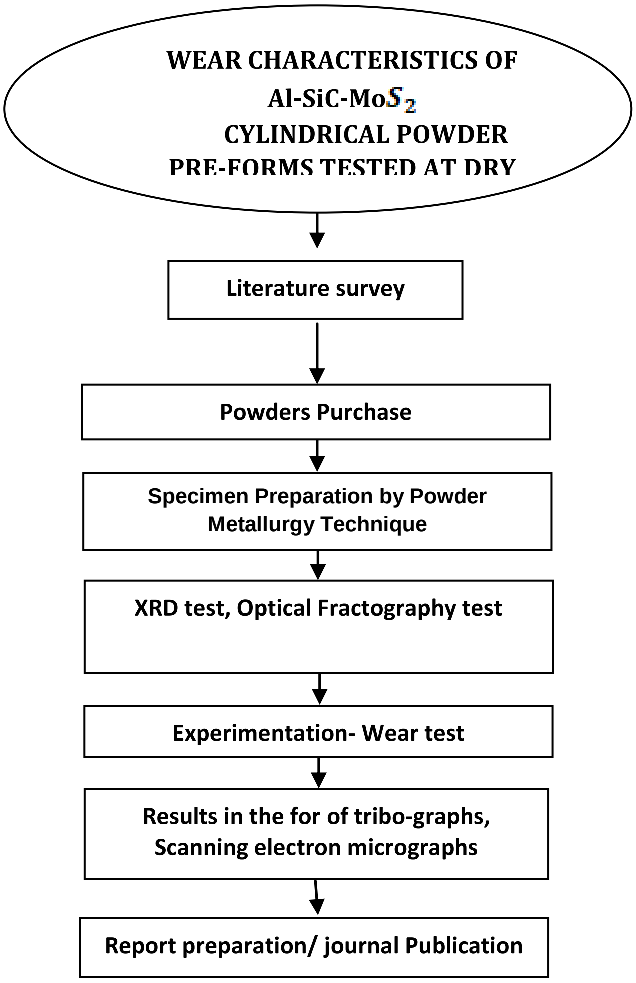
1. Leonardo Israel Fanfan Cabrera et al., Masoud Hashemi and `Akshaya A. Joshi reported the experimental results on wear characteristics of lubricant, materials and coatings using pin-on-disc apparatus respectively.
2. Meng et al. analyzed many available wear models and equations and found that there is no single or group of equations that is general and of practical use.
3. Ravi et al. studied the effect of pin contact geometry and reported that the performance of circular cross-section of pin is inferior to that of a square/rectangular contact configuration of the pin.
4. Peter J. Belau studied the effects of temperature on the mechanical properties as well as the tribological behavior of different materials at elevated temperatures. It is shown that, at elevated temperatures, the rate of wear depends on the contact conditions and nature of the oxide layer formation.
5. Li et al. researched on the influence of porosities present on the surface and in the bulk of the material in parts made by powder metallurgy process. It is shown that the friction and wear coefficients are influenced by the porosities on or near the surface of contact.
6. Ramesh et al. investigated the hardness and wear properties of Al6061-SiC composites with varying weight percentages of SiC that are fabricated by powder metallurgy process. The hardness tests were conducted using Rockwell hardness testing machine and pin-on-disk wear testing machine was used for dry sliding wear tests at different normal loads at different sliding velocities.
7. Tuti et al. conducted wear tests on a pin-on-disk apparatus to understand the influence of size and shape of the pin, load, speed and the material pairs on the wear characteristics of as-cast and heat-treated Al-Si eutectic alloys.
8. Kori et al. studied the effect of grain refiner and/or modifier on the wear behavior of hypoeutectic (Al–0.2, 2, 3, 4, 5 and 7Si) and eutectic (Al–12Si) alloys. A pin-on-disc wear testing machine under dry sliding conditions was used for the purpose.
9. Rajaram et al. have investigated the influence of temperature on the tensile and wear properties of Al-Si alloy specimens prepared by stir-casting process.
10. Dhirendra et al. studied the effects of alloying elements on the wear characteristics of binary Al17wt%Si alloy and multi-component (Al–17Si–0.8Ni–0.6Mg–1.2Cu–0.6Fe) cast alloy. Turabian the wear behavior of Al-Si alloys under the influence of alloy composition, sliding distance, sliding speed and load is reported by Turabian et al.
11. Rao et al. investigated different wear mechanisms in aluminum matrix composite using the concept of wear mechanism map. It is shown that four wear regimes exist viz., ultra-mild wear, mild wear or oxidative wear, delamination wear and severe wear.

### 1.6 Inferences

From the extensive survey, it is found that there is no standard tribometer test, experimental setups generally utilize similar design philosophies. Pin-on-disc, Pin-on-flat and pin-on-cylinder are amongst the commonly used wear testing apparatus. The Pin-on-disc in its simplest form, a flat sample is slid against the flat surface of a much larger and harder block of material called the counter face. This results in an approximately uniform pressure distribution within the sample.

In many cases, the counter face material and surface finish are important factors in system performance. Upon sliding, the frictional and normal forces are measured or inferred at the specimen simultaneously.

### 1.7 Methodology



### 1.8 EXPERIMENTATION

The Al-SiC Metal Matrix Composites can be formed in different compositions. Here we are using the composition as

- Al – 96%
- SiC – 2%
- $MoS_2$ – 2%. The powder is mixed thoroughly using a mixer. The powder should be mixed well so the MMC will be in perfect shape.

| SPECIMEN | ALUMINIUM POWDER | SILICON CARBIDE | MOLYBDENUM DISULPHIDE | LOAD COMPACTED(KGF) |
|---|---|---|---|---|
| SPECIMEN1 (SMALL) | 45grams | 2grams | 3grams | 19,700 |
| SPECIMEN2 (LARGE) | 64grams | 4grams | 2grams | 19550 |
| SPECIMEN3(REMOVAL) | 66grams | 2grams | 2grams | 32000 |

### 1.9 COMPACTION

The die in which the specimen is to be compacted is initially lubricated, so easy and smooth ejection is possible. Here Molybdenum di sulphide powder was used for lubrication purpose. The mixed powder in now carefully filled into the die. After each small quantity a compaction should be given using hand. After filling the die with the powder to the top the plunger is fixed and the whole setup is fixed on the UTM. The pressure is applied. The pressure can be varied according to the strength of the die. Here we applied three varied pressures 200KN, 250KN and 300KN. The pressure should be applied uniformly and slowly so that the specimen will not be damaged. After the required pressure is attained the UTM is stopped and now the ejection procedure is to be started. For ejecting the specimen, a special setup has to be made. The die is removed from the base and kept at a height, so the easy and smooth ejection can be attained. Now as before pressure is applied on to the specimen again. As there is no base the specimen will start to eject through the bottom. Finally, we will get the required specimen. After the ejection the die has to be opened and cleaned thoroughly so as to remove the pre-forms on the walls of the die.

**Figure 1.9: Compacting in UTM**

### 1.10 SINTERING

The ejected specimen has to be sintered. The sintering is done in a furnace at a controlled temperature. The sintering temperature can also be varied. Here we fixed the sintering temperature as 600°. The specimen should be kept at this temperature for at least 3hrs. After 3hrs the furnace is switched off and the specimen is allowed to furnace cooling. After the furnace cooling, we get our required specimen for wear testing.

**Figure 1.10: Sintering Process**

### SPECIFICATION OF THE SPECIMEN PREPARED

Material selected: Al-SiC-$MoS_2$ MMC

**Pin specification:**

Diameter: 24mm

Height: 50mm

### 1.11 Wear test

After the specimen is prepared and sintered the specimen is subjected to wear testing. The wear testing is done on a tribometer or pin on disc experimental setup. The pin on disc apparatus is shown in the figure.

**Figure 1.11: Pin on Disc apparatus**

The initial height of the specimen and the initial weight of the specimen are measured so as to find the wear rates. Abrasive papers of different grades such as 80,100,180 were used for the experimentation.

**Figure 1.12: 80 grit paper Figure 1.13: 100 grit paper**

**Figure 1.14: 180 grit paper**

The emery sheets are pasted on to the disc of the pin on disc apparatus. The specimen is made to hold on to the pin of the pin on disc apparatus using holder. The pin with specimen and the disc with abrasive paper are now brought to contact. Now the motor is switched so that the disc will rotate, and wear will occur to the specimen. The speed of the motor can be varied using varies. Different parameters are changed to find the wear at different conditions. The parameters that are varied are applied load on the specimen, grades of emery sheets, speed of the motor, and the compacting pressure on the specimen. The tabulated values are converted into graphical form and are compared. Using the observed values, the following graph is drawn,

- Weight loss vs applied load

### 2.1 OBSERVATIONS

Compact Load:200KN

Sintered Temperature: 600°c

Table: 2.1.1 Load vs weight loss, 200KN, grit-80, sliding velocity 300rpm

| Sliding velocity: 300rpm Grit size: 80 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 22.76 | 22.30 | .46 |
| 70 | 22.30 | 21.82 | .48 |
| 90 | 21.82 | 21.33 | .49 |

Table: 2.1.2 Load vs weight loss, 200KN, grit-80, sliding velocity 400rpm

| Sliding velocity: 400rpm Grit size: 80 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 21.33 | 20.77 | .56 |
| 70 | 20.77 | 20.2 | .57 |
| 90 | 20.2 | 19.61 | .59 |

Table: 2.1.3 Load vs weight loss, 200KN, grit-80, sliding velocity 500rpm

| Sliding velocity :500rpm Grit size: 80 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 19.61 | 19.00 | .61 |
| 70 | 19.00 | 18.35 | .65 |
| 90 | 18.35 | 17.69 | .71 |

Compact Load: 250KN

Sintered Temperature: 600°c

Table: 2.2.1 Load vs Weight loss, 250KN, grit -80, sliding velocity 300rpm

| Sliding velocity: 300rpm Grit size: 80 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 25.08 | 24.6 | 0.48 |
| 70 | 24.6 | 24.07 | 0.53 |
| 90 | 24.07 | 23.51 | 0.56 |

Table: 2.2.2 Load vs Weight loss, 250KN, grit -80, sliding velocity 300rpm

| Sliding velocity: 400rpm Grit size: 80 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 23.61 | 22.96 | 0.65 |
| 70 | 22.96 | 22.3 | 0.66 |
| 90 | 22.3 | 21.62 | 0.68 |

Table: 2.2.3 Load vs Weight loss, 250KN, grit -80, sliding velocity 300rpm

| Sliding velocity: 400rpm Grit size: 80 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 23.61 | 22.96 | 0.65 |
| 70 | 22.96 | 22.3 | 0.66 |
| 90 | 22.3 | 21.62 | 0.68 |

Compact Load:300KN

Sintered Temperature: 600°c

Table: 2.3.1 Load vs Weight loss, 300KN, grit-80, sliding velocity 300rpm

| Sliding velocity: 300rpm Grit size: 80 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 32.5 | 32 | 0.5 |
| 70 | 32 | 31.44 | 0.56 |
| 90 | 31.44 | 30.8 | 0.64 |

Table: 2.3.2 Load vs Weight loss, 300KN, grit-80, sliding velocity 400rpm

| Sliding velocity: 400rpm Grit size: 80 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 30.8 | 30.01 | 0.7 |
| 70 | 30.01 | 29.38 | 0.72 |
| 90 | 29.38 | 28.55 | 0.83 |

Table: 2.3.3 Load vs Weight loss, 300KN, grit-80, sliding velocity 500rpm

| Sliding velocity: 500rpm Grit size: 80 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 28.55 | 27.8 | 0.75 |
| 70 | 27.8 | 27.4 | 0.76 |
| 90 | 27.4 | 26.3 | 0.84 |

Compact Load: 200KN

Sintered Temperature: 600°c

Table: 2.4.1 Load vs Weight loss, 200KN, grit-100, sliding velocity 300rpm

| Sliding velocity: 300rpm Grit size: 100 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 18.09 | 17.57 | 0.52 |
| 70 | 17.57 | 17.02 | 0.55 |
| 90 | 17.02 | 16.46 | 0.56 |

Table: 2.4.2 Load vs Weight loss, 200KN, grit-100, sliding velocity 400rpm

| Sliding velocity: 400rpm Grit size: 100 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 16.46 | 15.9 | 0.56 |
| 70 | 15.9 | 15.31 | 0.59 |
| 90 | 15.31 | 14.66 | 0.65 |

Table: 2.4.3 Load vs Weight loss, 200KN, grit-100,sliding velocity 500rpm

| Sliding velocity: 500rpm Grit size: 100 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 14.66 | 14.05 | 0.61 |
| 70 | 14.05 | 13.43 | 0.62 |
| 90 | 13.43 | 12.75 | 0.68 |

Compact Load: 250KN

Sintered Temperature: 600°c

Table: 2.5.1 Load vs Weight loss, 250KN, grit-100, sliding velocity 300rpm

| Sliding velocity: 300rpm Grit size: 100 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 19.81 | 19.27 | 0.54 |
| 70 | 19.27 | 18.69 | 0.58 |
| 90 | 18.69 | 18.1 | 0.59 |

Table: 2.5.2 Load vs Weight loss, 250KN, grit-100, sliding velocity 400rpm

| Sliding velocity: 400rpm Grit size: 100 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 18.1 | 17.5 | 0.6 |
| 70 | 17.5 | 16.88 | 0.62 |
| 90 | 16.88 | 16.2 | 0.68 |

Table: 2.5.3 Load vs Weight loss, 250KN, grit-100, sliding velocity 500rpm

| Sliding velocity: 500rpm Grit size: 100 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 16.2 | 15.52 | 0.68 |
| 70 | 15.52 | 14.81 | 0.71 |
| 90 | 14.81 | 14.06 | 0.75 |

Compact Load: 300KN

Sintered Temperature: 600°c

Table: 2.6.1 Load vs Weight loss, 100KN, grit-100, sliding velocity 300rpm

| Sliding velocity: 300rpm Grit size: 100 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 29.09 | 28.34 | 0.75 |
| 70 | 28.34 | 27.57 | 0.77 |
| 90 | 27.57 | 26.78 | 0.79 |

Table: 2.6.2 Load vs Weight loss, 100KN, grit-100, sliding velocity 400rpm

| Sliding velocity: 400rpm Grit size: 100 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 26.78 | 26.02 | 0.76 |
| 70 | 26.02 | 25.25 | 0.77 |
| 90 | 25.25 | 24.45 | 0.8 |

Table: 2.6.3 Load vs Weight loss, 100KN, grit-100, sliding velocity 500rpm

| Sliding velocity: 500rpm Grit size: 100 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 24.45 | 23.7 | 0.77 |
| 70 | 23.7 | 21.36 | 0.8 |
| 90 | 21.36 | 20.55 | 0.81 |

Compact Load: 200KN

Sintered Temperature: 600°c

Table: 2.7.1 Load vs Weight loss, 200KN, grit-180,sliding velocity 300 rpm

| Sliding velocity: 300rpm Grit size: 180 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 18.09 | 17.53 | 0.56 |
| 70 | 17.53 | 16.94 | 0.59 |
| 90 | 16.94 | 16.33 | 0.61 |

Table: 2.7.2 Load vs Weight loss, 200KN, grit-180, sliding velocity 400 rpm

| Sliding velocity: 400rpm Grit size: 180 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 16.33 | 15.76 | 0.57 |
| 70 | 15.76 | 15.15 | 0.61 |
| 90 | 15.15 | 14.49 | 0.66 |

Table: 2.7.3 Load vs Weight loss, 200KN, grit-180, sliding velocity 500 rpm

| Sliding velocity: 500rpm Grit size: 180 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 14.49 | 13.9 | 0.59 |
| 70 | 13.9 | 13.28 | 0.62 |
| 90 | 13.28 | 12.58 | 0.7 |

Compact Load:250KN
Sintered Temperature: 600°c
Table: 2.8.1 Load vs Weight loss, 250KN, grit-180,sliding velocity 300rpm

| Sliding velocity: 300rpm Grit size: 180 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 13.42 | 12.81 | 0.61 |
| 70 | 12.81 | 12.18 | 0.63 |
| 90 | 12.18 | 11.52 | 0.66 |

Table: 2.8.2 Load vs Weight loss, 250KN, grit-180,sliding velocity 400rpm

| Sliding velocity: 400rpm Grit size: 180 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 11.52 | 10.87 | 0.65 |
| 70 | 10.87 | 10.19 | 0.68 |
| 90 | 10.19 | 9.48 | 0.71 |

Table: 2.8.3 Load vs Weight loss, 250KN, grit-180,sliding velocity 500rpm

| Sliding velocity: 500rpm Grit size: 180 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 9.48 | 8.79 | 0.69 |
| 70 | 8.79 | 8.09 | 0.7 |
| 90 | 8.09 | 7.37 | 0.72 |

Compact Load:300KN
Sintered Temperature: 600°c

Table: 2.9.1 Load vs Weight loss, 300KN, grit-180, sliding velocity 300rpm

| Sliding velocity: 300rpm Grit size: 180 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 20.55 | 19.92 | 0.63 |
| 70 | 19.92 | 19.27 | 0.65 |
| 90 | 19.27 | 18.58 | 0.69 |

Table: 2.9.2 Load vs Weight loss, 300KN, grit-180, sliding velocity 400rpm

| Sliding velocity: 400rpm Grit size: 180 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 18.58 | 17.91 | 0.67 |
| 70 | 17.91 | 17.2 | 0.71 |
| 90 | 17.2 | 16.48 | 0.72 |

Table: 2.9.3 Load vs Weight loss, 300KN, grit-180, sliding velocity 500rpm

| Sliding velocity: 500rpm Grit size: 180 | | | |
|---|---|---|---|
| LOAD IN MPA | INITIAL WEIGHT(GMS) | FINAL WEIGHT(GMS) | WEAR LOSS IN G |
| 50 | 16.48 | 15.77 | 0.71 |
| 70 | 15.77 | 15.05 | 0.72 |
| 90 | 15.05 | 14.3 | 0.75 |

### 2.10 TRIBO-GRAPHS

200KN 300RPM 80GRIT

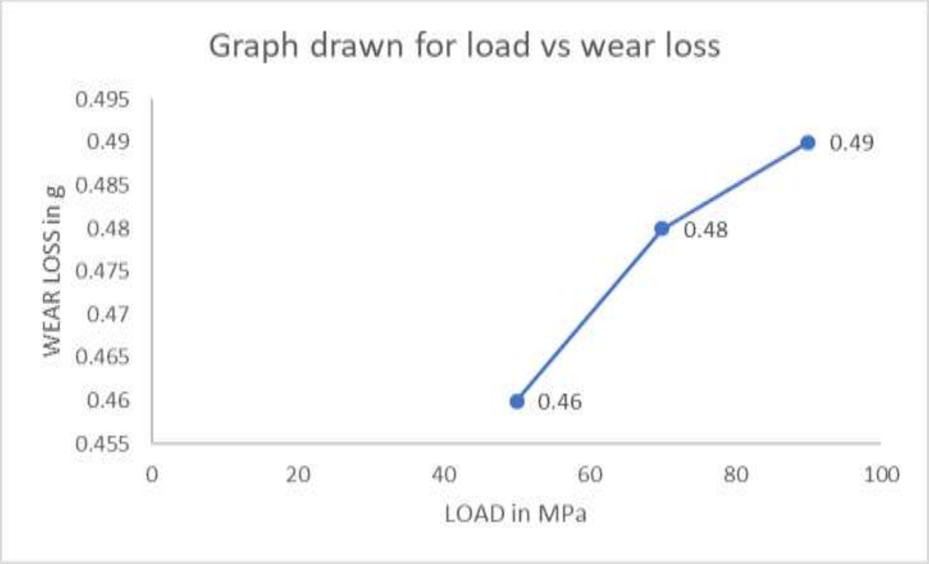


Fig 2.10.1

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.46 |
| 70 | 0.48 |
| 90 | 0.49 |

200KN 400RPM 80GRIT

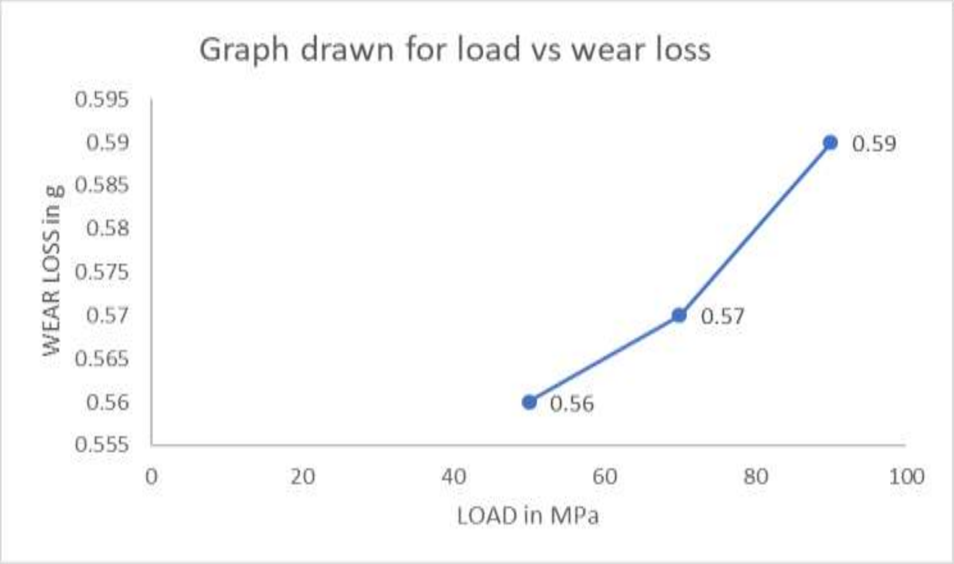


Fig 2.10.2

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.56 |
| 70 | 0.57 |
| 90 | 0.59 |

200KN 500RPM 80 GRIT

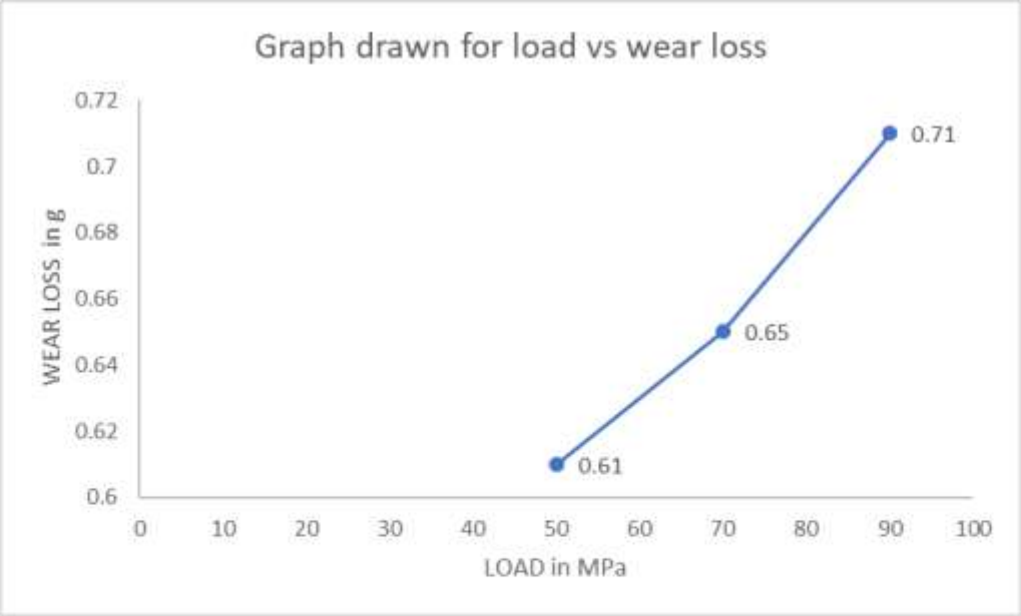


Fig 2.10.3

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.61 |
| 70 | 0.65 |
| 90 | 0.71 |

250KN 300RPM 80GRIT

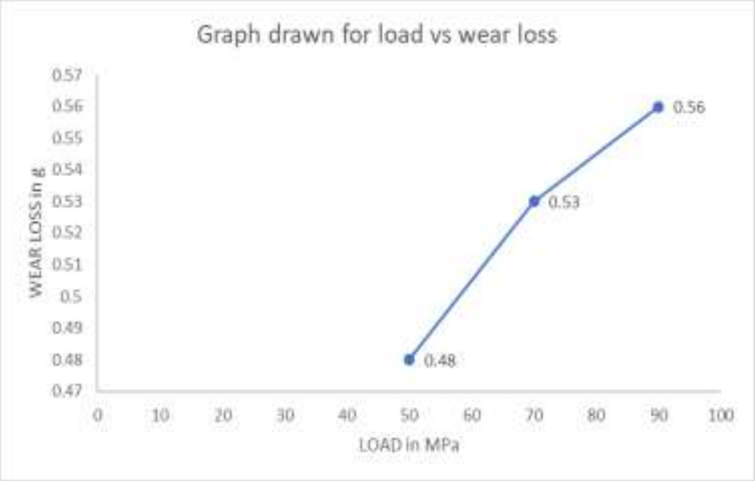


Fig 2.10.4

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.48 |
| 70 | 0.53 |
| 90 | 0.56 |

250KN 400RPM 80GRIT

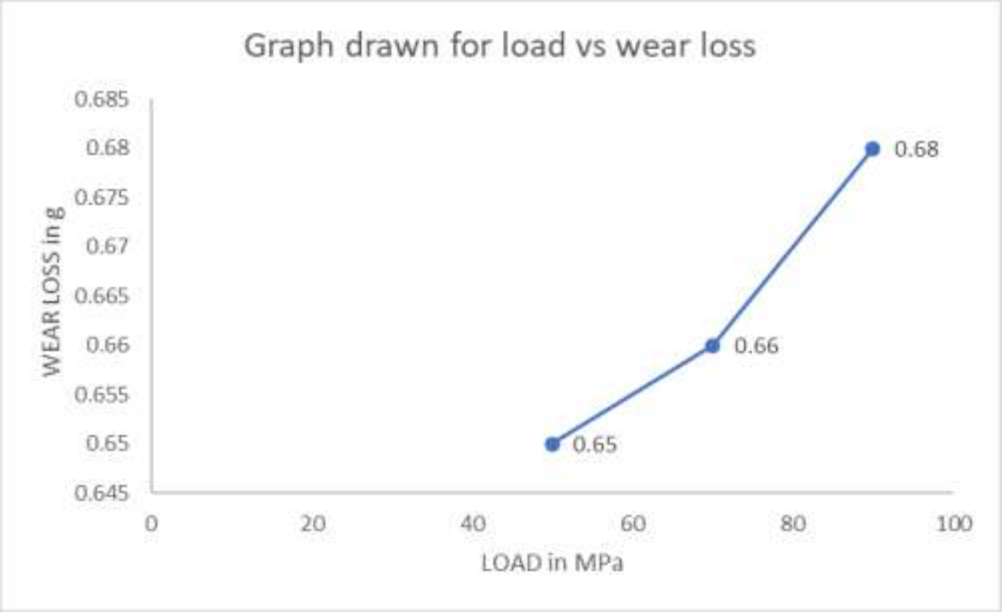


Fig 2.10.5

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.65 |
| 70 | 0.66 |
| 90 | 0.68 |

250KN 500RPM 80GRIT

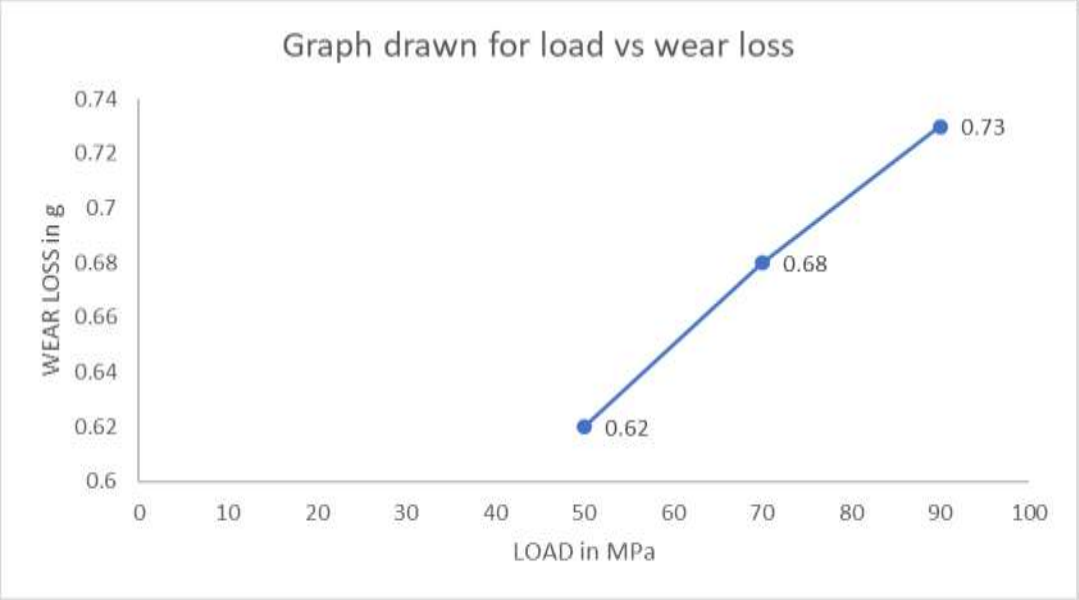


Fig 2.10.6

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.62 |
| 70 | 0.68 |
| 90 | 0.73 |

300KN 300RPM 80GRIT

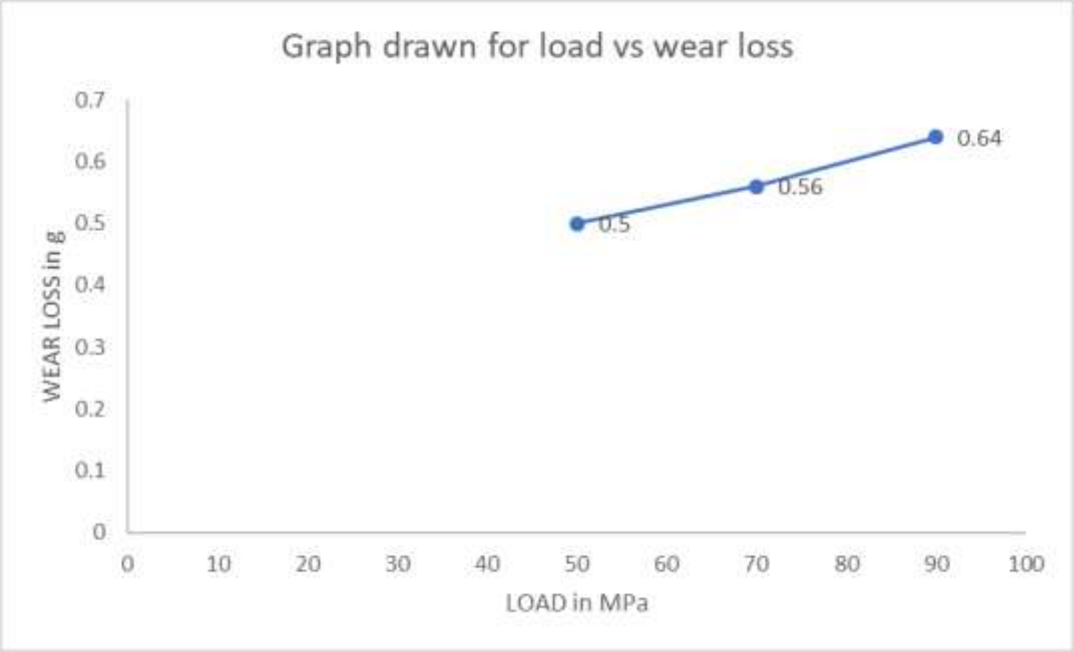


Fig 2.10.7

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.5 |
| 70 | 0.56 |
| 90 | 0.64 |

300KN 400RPM 80GRIT

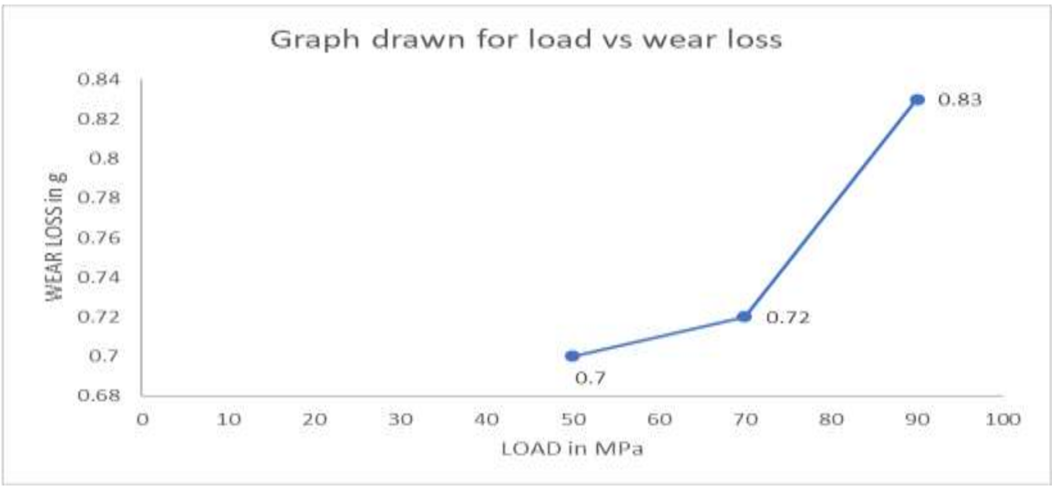


Fig 2.10.8

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.7 |
| 70 | 0.72 |
| 90 | 0.83 |

300KN 500RPM 80GRIT

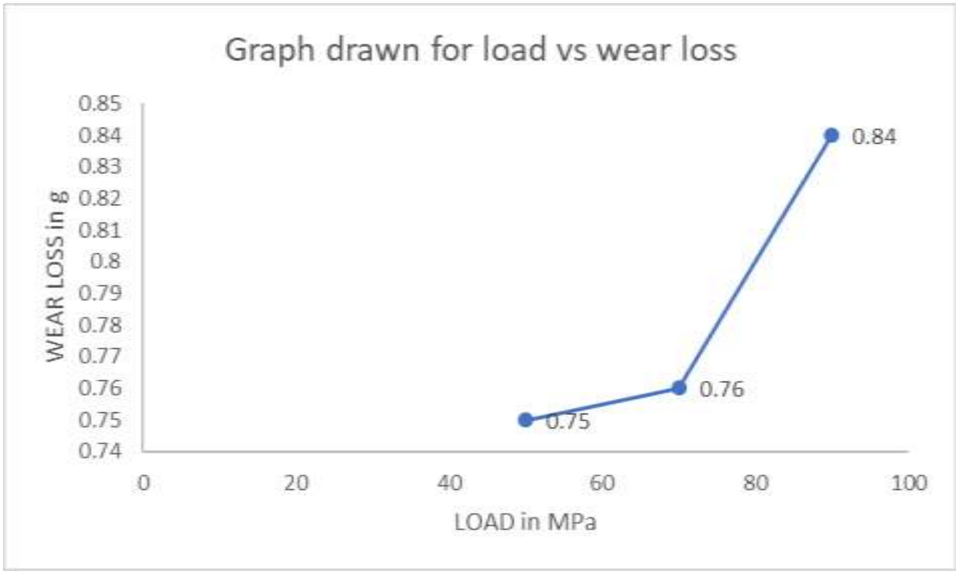


Fig 2.10.9

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.75 |
| 70 | 0.76 |
| 90 | 0.84 |

200KN 300RPM 100GRIT

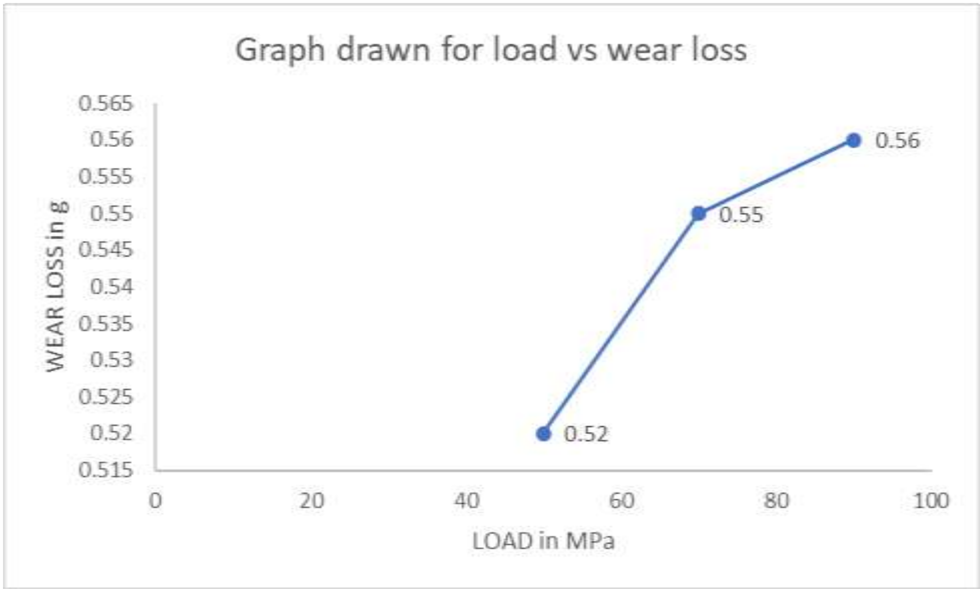


Fig 2.10.10

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.52 |
| 70 | 0.55 |
| 90 | 0.56 |

200KN 400RPM 100GRIT

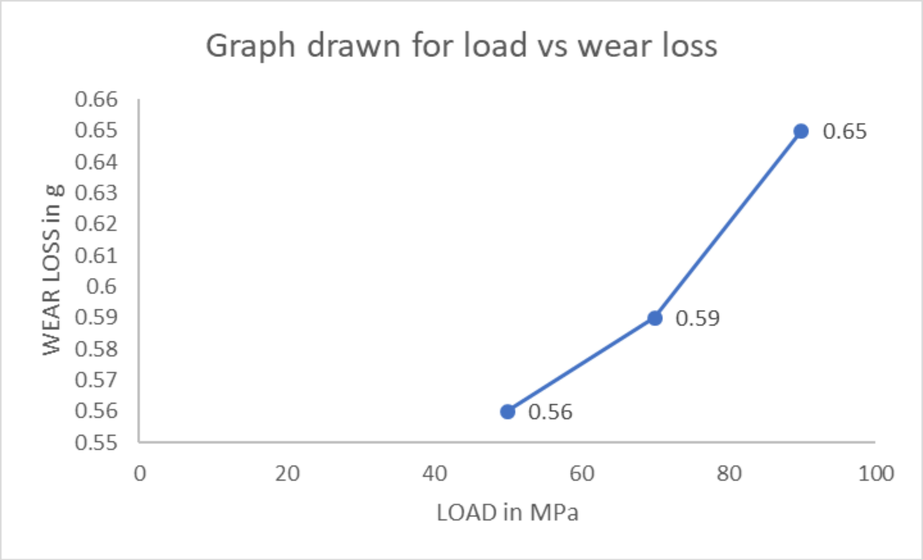


Fig 2.10.11

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.56 |
| 70 | 0.59 |
| 90 | 0.65 |

200KN 500RPM 100GRIT

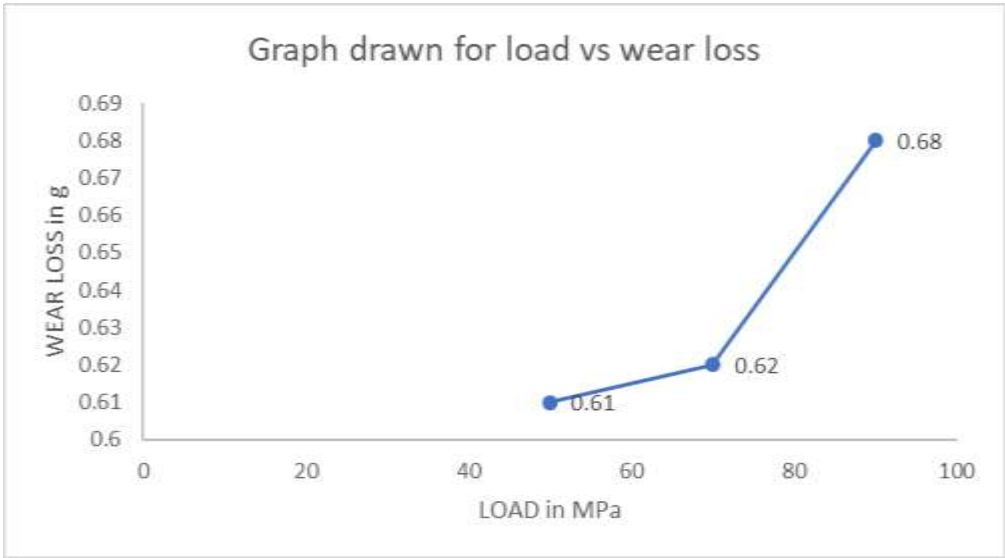


Fig 2.10.12

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.61 |
| 70 | 0.62 |
| 90 | 0.68 |

250KN 300RPM 100GRIT

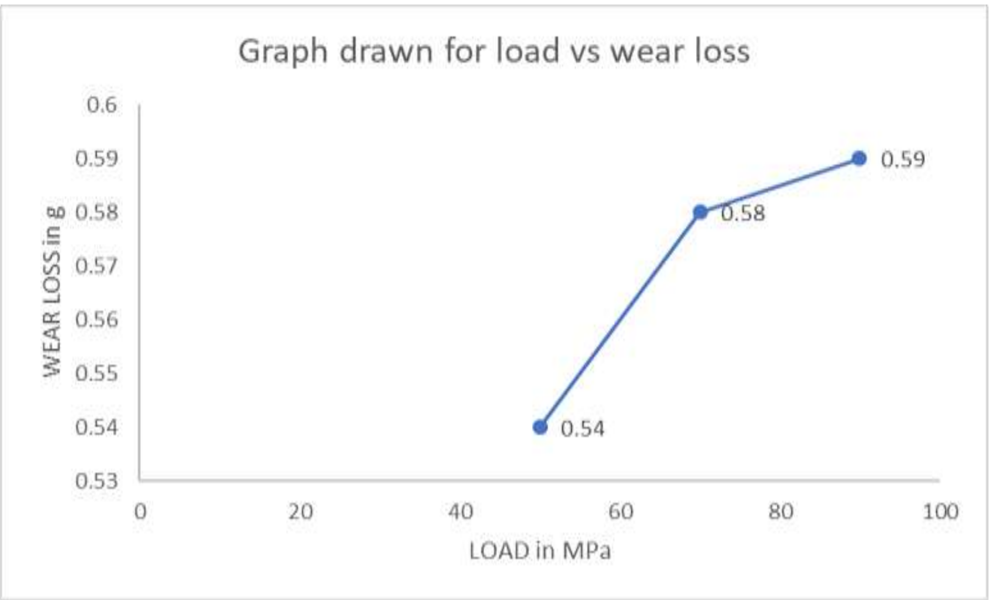


Fig 2.10.13

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.54 |
| 70 | 0.58 |
| 90 | 0.59 |

250KN 400RPM 100GRIT

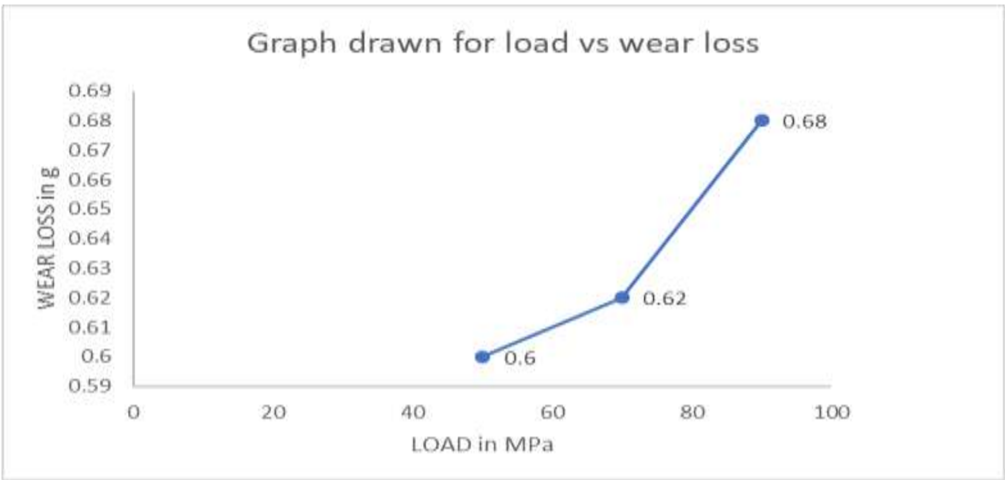


Fig 2.10.14

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.6 |
| 70 | 0.62 |
| 90 | 0.68 |

250KN 500RPM 100GRIT

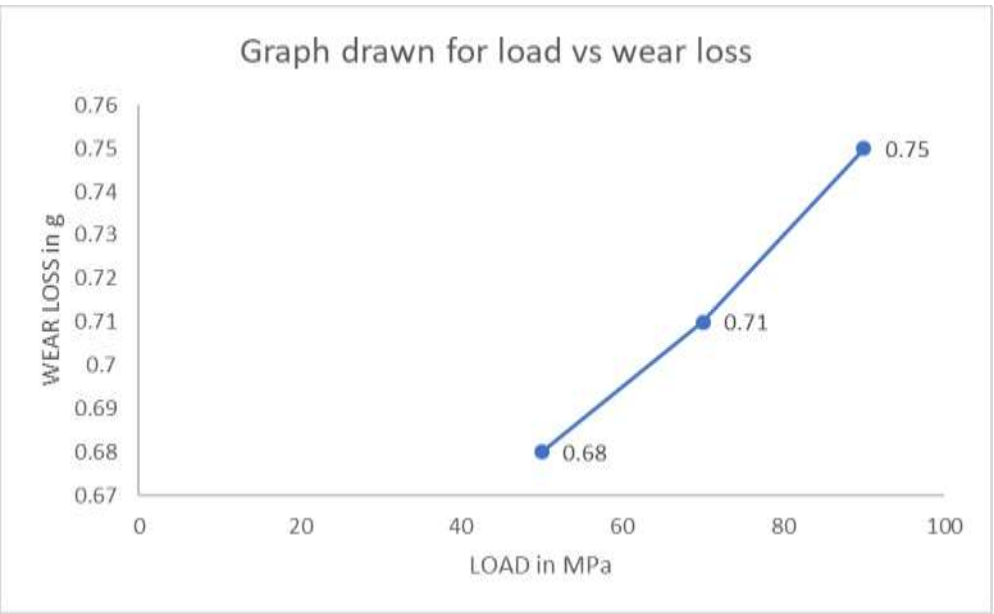


Fig 2.10.15

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.68 |
| 70 | 0.71 |
| 90 | 0.75 |

300KN 300RPM 100GRIT

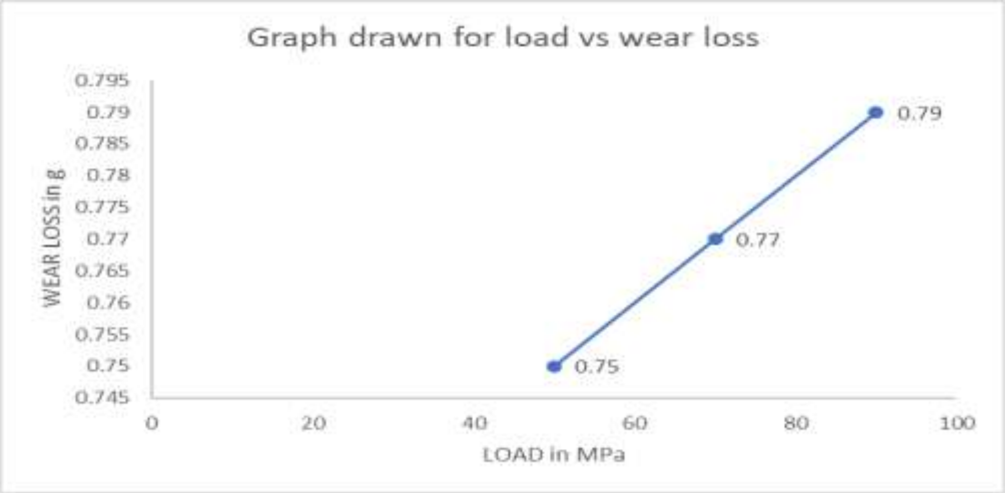


Fig 2.10.16

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.75 |
| 70 | 0.77 |
| 90 | 0.79 |

300KN 400RPM 100GRIT

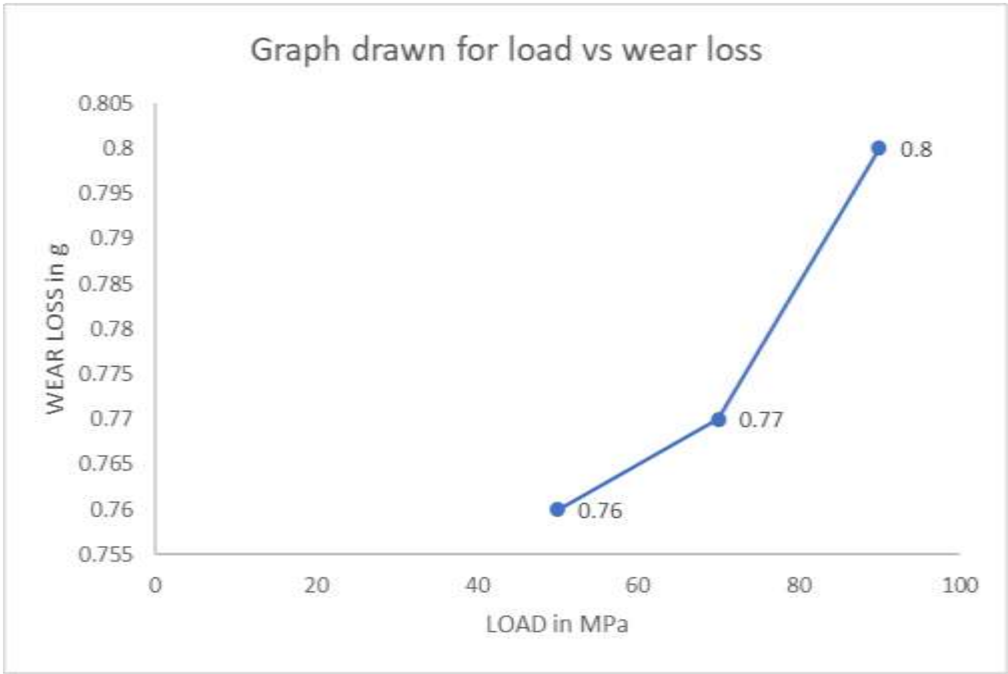


Fig 2.10.17

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.76 |
| 70 | 0.77 |
| 90 | 0.8 |

300KN 500RPM 100GRIT

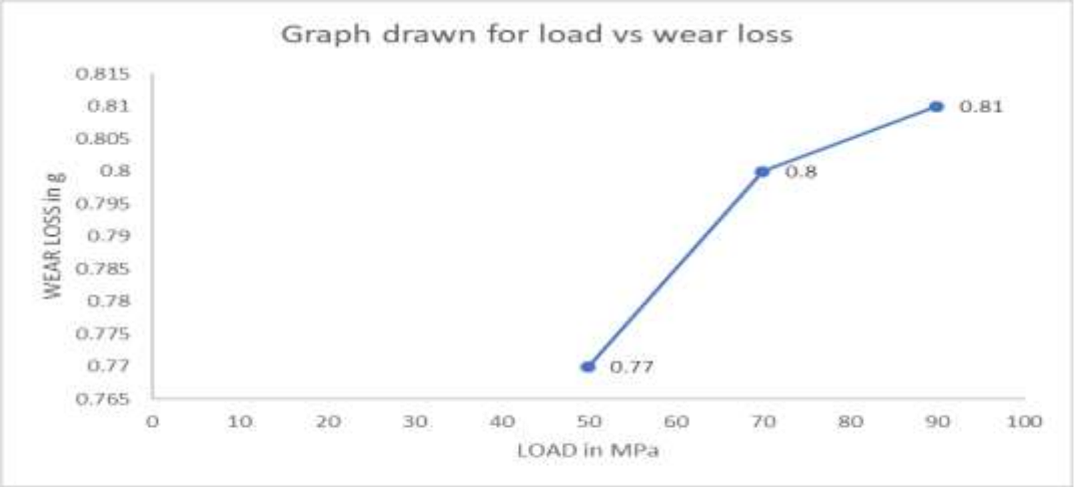


Fig 2.10.18

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.77 |
| 70 | 0.8 |
| 90 | 0.81 |

200KN 300RPM 180GRIT

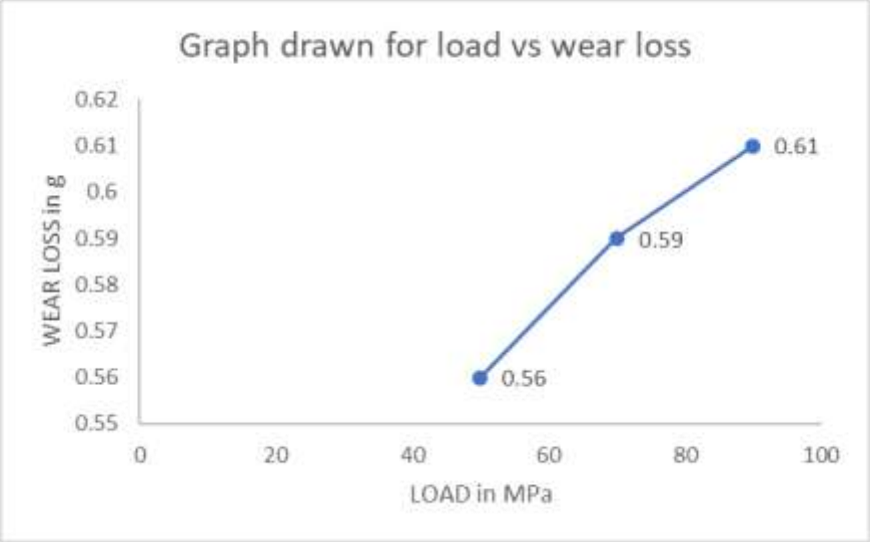


Fig 2.10.19

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.56 |
| 70 | 0.59 |
| 90 | 0.61 |

200KN 400RPM 180GRIT

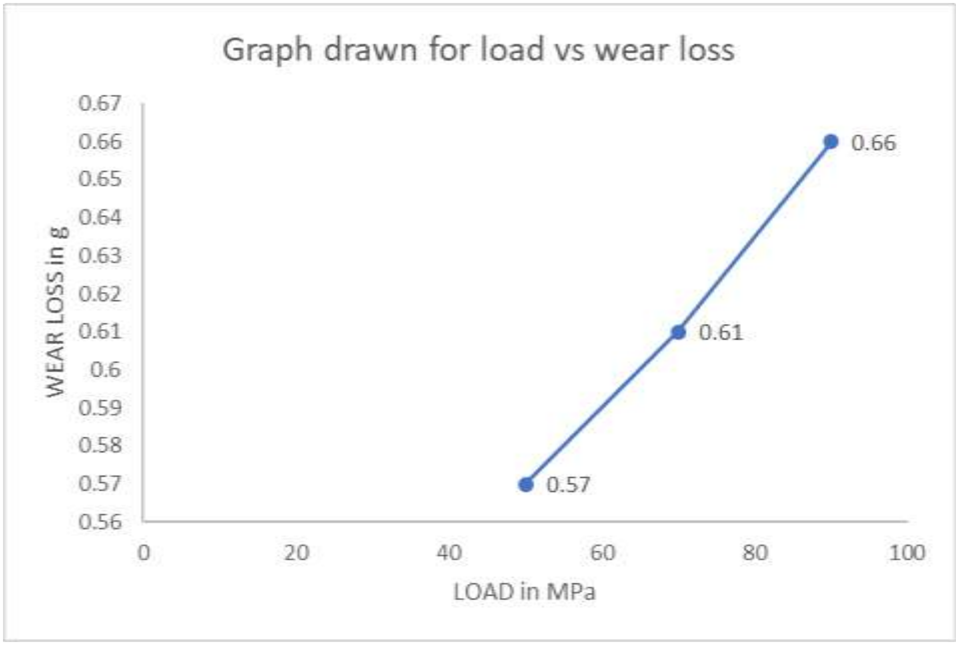


Fig 2.10.20

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.57 |
| 70 | 0.61 |
| 90 | 0.66 |

200KN 500RPM 180GRIT

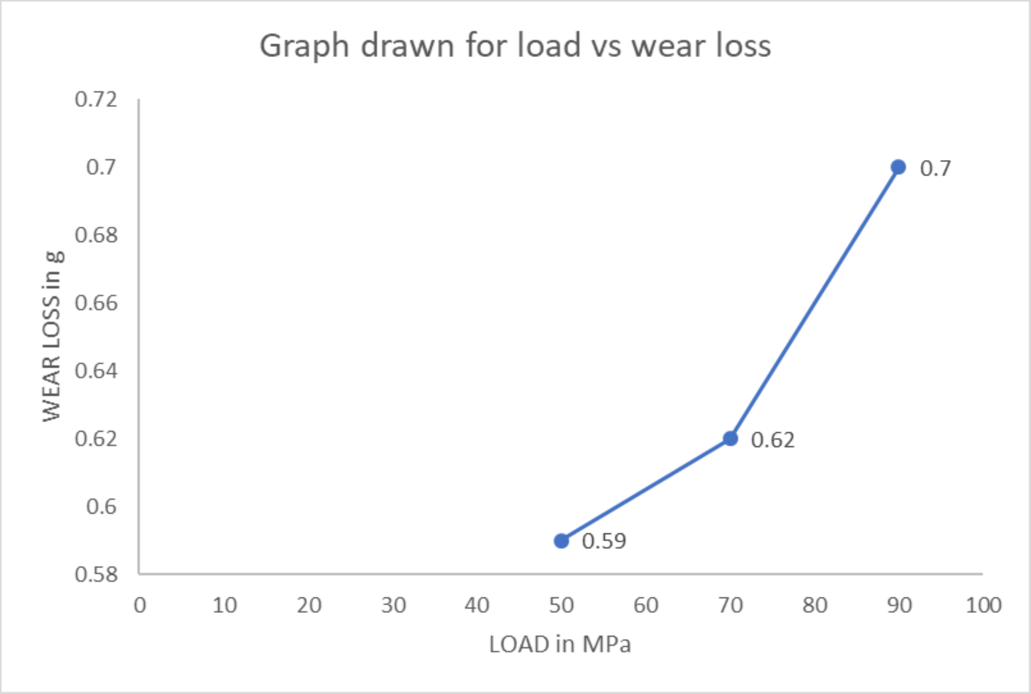


Fig 2.10.21

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.59 |
| 70 | 0.62 |
| 90 | 0.7 |

250KN 300RPM 180 GRIT

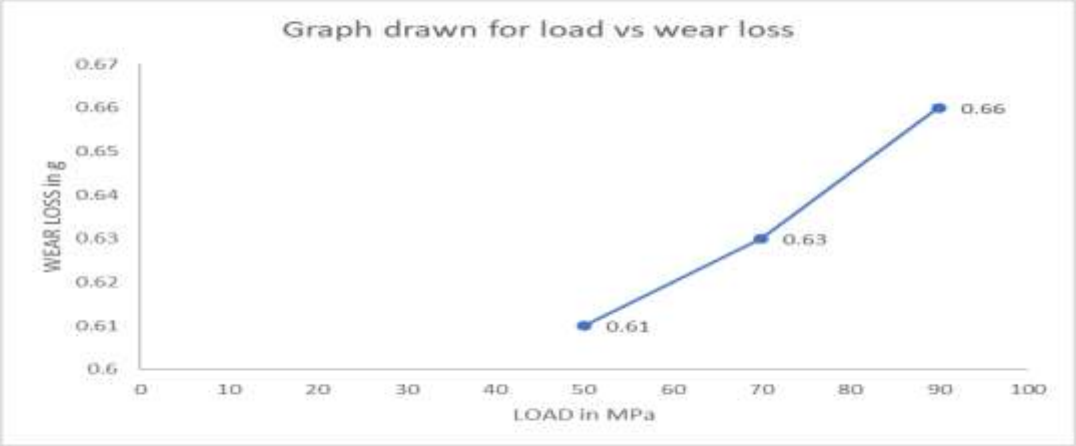


Fig 2.10.22

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.61 |
| 70 | 0.63 |
| 90 | 0.66 |

250KN 400RPM 180 GRIT

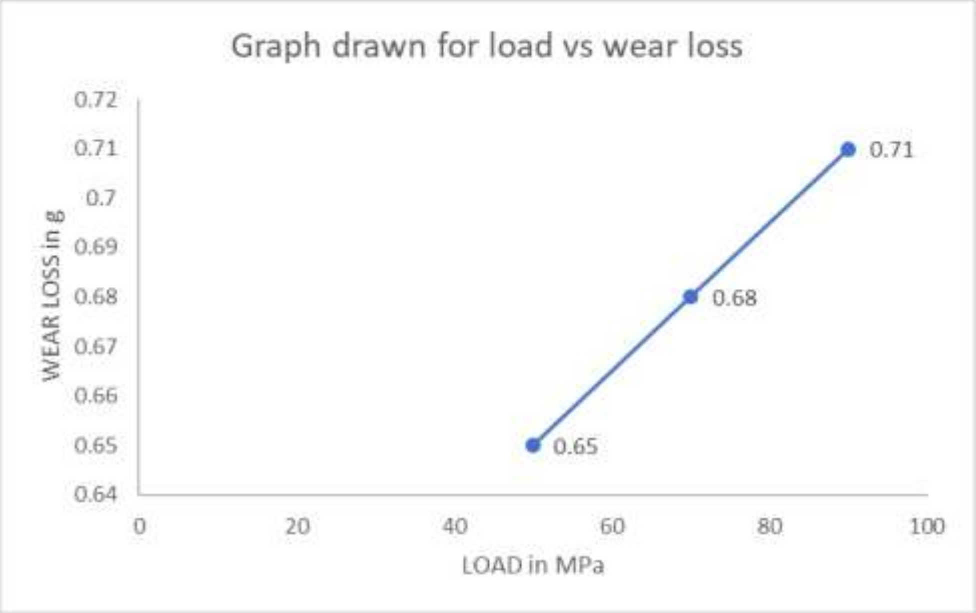


Fig 2.10.23

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.65 |
| 70 | 0.68 |
| 90 | 0.71 |

250KN 500RPM 180 GRIT

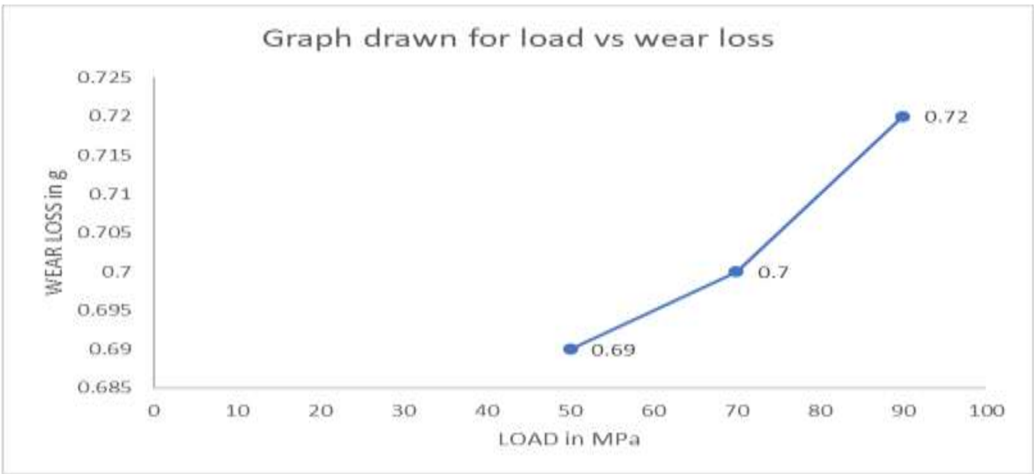


Fig 2.10.24

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.69 |
| 70 | 0.7 |
| 90 | 0.72 |

300KN 300RPM 180 GRIT

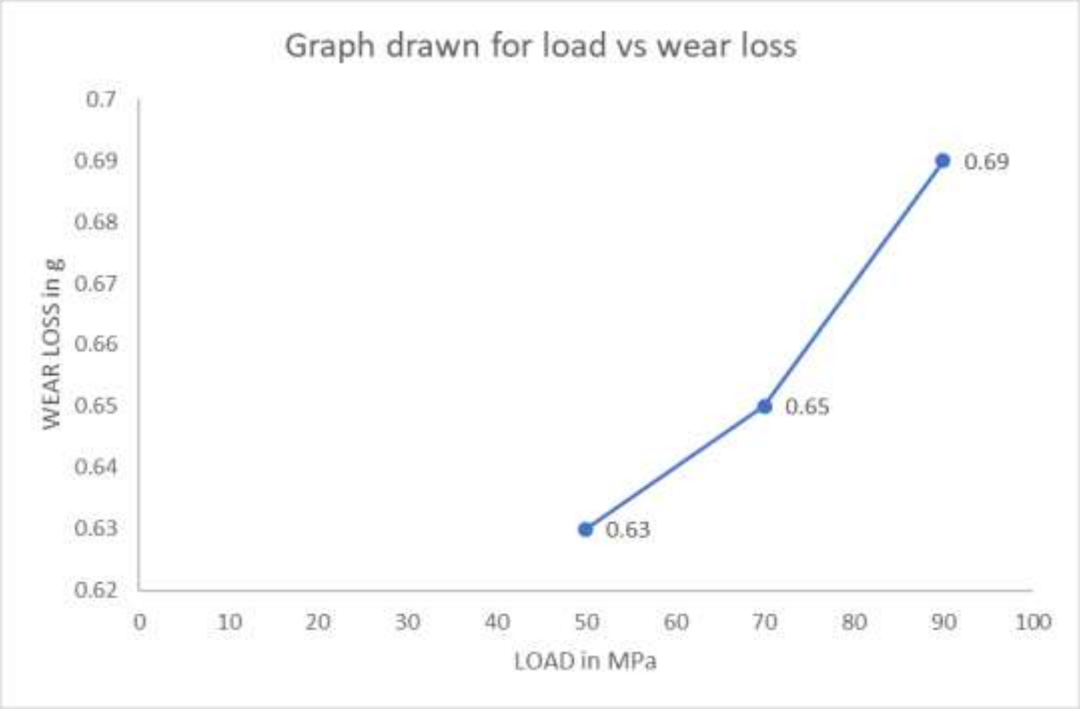


Fig 2.10.25

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.63 |
| 70 | 0.65 |
| 90 | 0.69 |

300KN 400RPM 180 GRIT

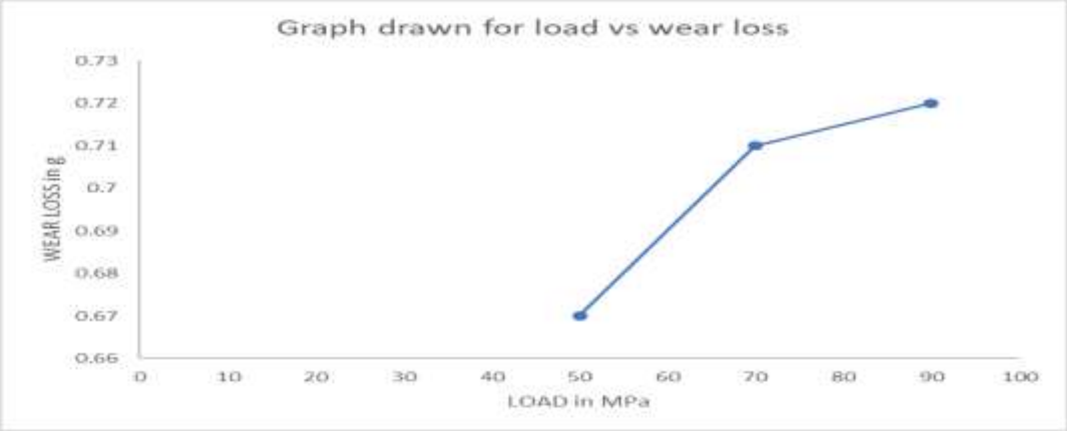


Fig 2.10.26

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.67 |
| 70 | 0.71 |
| 90 | 0.72 |

300KN 500RPM 180 GRIT

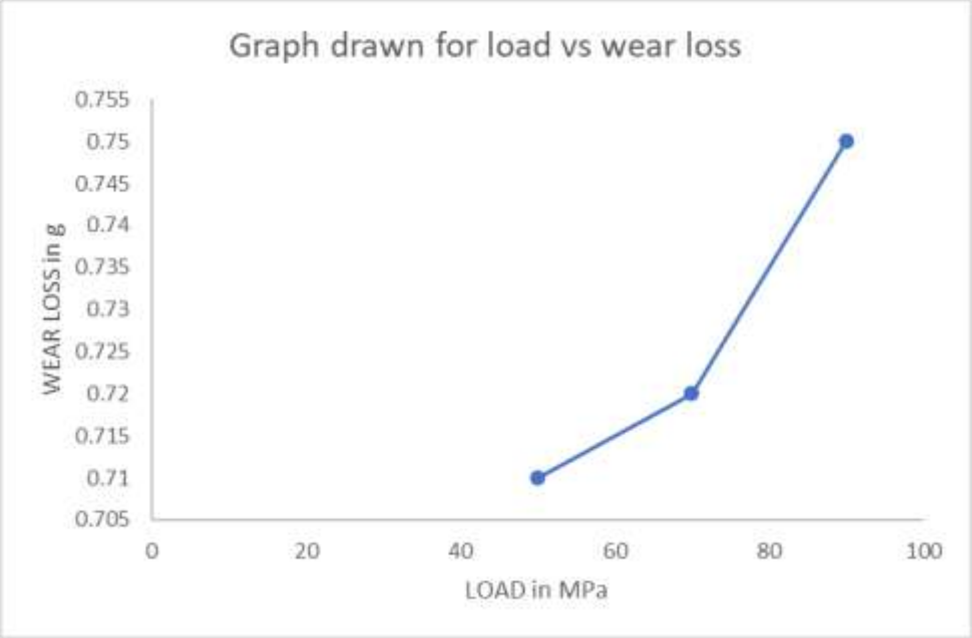


Fig 2.10.27

| LOAD in MPa | WEAR LOSS in g |
|---|---|
| 50 | 0.71 |
| 70 | 0.72 |
| 90 | 0.75 |

## 2.11 Inferences

- Figure 5.1 to 5.1.27, shows the graph between wear loss and applied load for room temperature and compacting pressure 200KN, 250KN and 300KN. Different abrasive grit papers are used to obtain the deviations. A gradual increase in the weight loss is observed as the applied load is increased. By comparing the curves for different grit sizes its observed that maximum weight loss is more for grit size for 80 and decreases as it comes down to 180.
- The compacting pressures are varied to obtain different curves. The weight loss initially decreases as the sliding velocity increases, reaches a critical value and then it increases.

## 3. CONCLUSIONS

- As the applied load increases weight loss increases.
- Wear is directly proportional to applied load on the specimen.
- Wear loss is also directly proportional to wear.
- As the abrasive grit size increases the specific wear rate decreases.
- Abrasive grit size is inversely proportional to wear rate.
- The weight loss initially decreases with increase in sliding velocity, reaches an optimum value and then increases.

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