

## **A study on Friction and Wear Comparative Analysis of Three PTFE Composite**

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**ABSTRACT:** The present research work is aimed at developing a new material for industrial application. The progress and developments in materials technology have resulted in several new materials. Polytetrafluoroethylene (PTFE) is one of them. From literature review it is found that conventional bearing material (Babbitt and bronze) leads to high wear rate as well as high coefficient of friction. Now a day's pure PTFE (Polytetrafluoroethylene) is widely used as bearing material which is self-lubricating and subjects to lower coefficient of friction, but problem with PTFE is that, it subjects to high wear rate, which can be reduced by adding suitable fillers. In this study, the effects of varying load, sliding distance, sliding velocity and filler content in PTFE are experimentally examine using a Pin –on –Disc Tribometer. A comparative analysis of three composites ( PTFE + 30% Carbon , PTFE + 30% bronze and PTFE+30%Glass) is presented showing how properties of PTFE can be improved by addition of filler content. The expected results taking into consideration the large number of factors, friction & wear characteristics and optimum bearing construction can be achieved.

**Index Terms-** PTFE composite, Taguchi Technique, Pinon Disc.

### **LINTRODUCTION**

Polytetrafluoroethylene (PTFE) is a synthetic Fluoropolymer of tetrafluoroethylenethat have numerous applications. The best known brand name of PTFE-based formulas is Teflon-by DuPont Co. Who discovered the compound. PTFE is a fluorocarbon solid, as it is a high weight Compound Consisting wholly of carbon and fluorine. PTFE is hydrophobic neither Water nor Water-containing substances wet PTFE, as Fluorocarbons demonstrate mitigated London Due to the high Electronegativity of fluorine. PTFE has one of the lowest coefficients of friction against any solid. PTFE is used as a non-stick coating for pans and other Cookware. It is very non-reactive, partly because of the strength of carbon–fluorine bonds and so it is often used in containers and pipework for Reactive and corrosive chemicals. Where used as a Lubricant, PTFE reduces friction, wear and energy Consumption of machinery. It is also commonly used as a graft material in surgical interventions. But the problem is that in industrial applications, owing to its low friction and high wear rate [1] Mehmet Turan Demircin [2] have learned the effect of sliding velocity, bearing pressure and temperature on friction and wear using PA66 (Polyamide 66), PA66 + 18% PTFE (Polyamide 66 + 18% Polytetrafluoroethylene) and PA66 + 20% GFR + 25% PTFE (Polyamide 66 + 20% glass fiber + 25% Polytetrafluoroethylene) journal bearings at room temperature.. The best wear behavior was found at the PA66 + 20% GFR + 25% PTFE journal bearing. Dinghan Xiang [3] has presented that A new (A) 16 MnNb steel–PTFE containing 60% Another solid lubricant (B) embedded C86300 bronze–PTFE containing 35% Friction and wear experiments were performed Results showed that the composite A exhibited low coefficient of dry friction and long wear life as compared to that of the composite B. Arash Golchin [4]. have explained the four PTFE composites were tested using reciprocating the

Tribometer at pressure 1 to 8 Mpa and temperature 25 to 85°C. PTFE containing bronze filled, carbon filled and pure PTFE are supply lower break away friction and having excellent properties. Deepak Bagale [5], have explained the wear rate of plain PTFE, and carbon and bronze filler. The wear rate decreases due to addition of above filler elements. J.R. Vail [6], have explained the comparison between expanded PTFE and powder filled

PTFE- PEEK composites .He found that expanded PTFE were better than powder filled PTFE and also constant coefficient of friction.

## **II.OBJECTIVE**

The objective of this research work is to generate the sustainable bearing materials for that we need to find out the effect of following composite materials on wear rate.

1. To find the effect of 30% Bronze filler in PTFE on wear rate.
2. To find the effect of 30% Carbon filler in PTFE on wear rate.
3. To find the effect of 30% glass filler in PTFE on wear rate.
4. To Study the wear behavior of the selected materials and the effect of various parameters like load, velocity of sliding and sliding distance on wear rate.

## **III.EXPERIMENTAL SET UP**

The test is conducted using a pin on disc Tribometer TR 20LE wear and friction monitor machine. It facilitates study of Friction and wear characteristics in sliding contact under desired conditions.as shown in fig1.

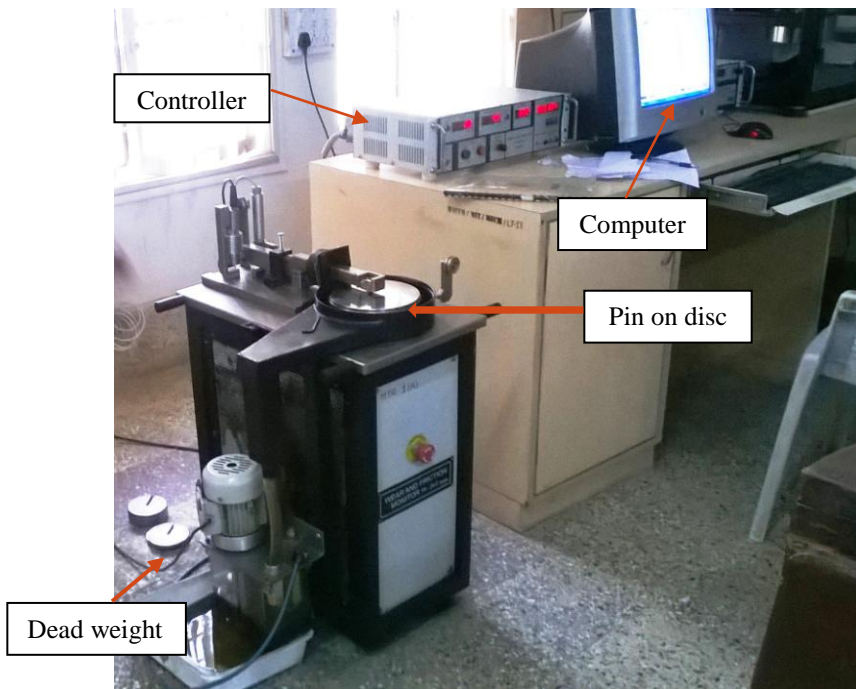


Fig1: Experimental set up of friction and wear test rig

### **Specifications**

1. Sample pin size: diameter 3mm -12mm, Length 25-30mm
2. Sample disc size: diameter 165 X 8mm thick
3. Wear track diameter: 50mm-100mm
4. Disc rotation speed: 200-2000rpm
5. Normal load: 0-200 N
6. Frictional force: 0-200N, least count 0.1N
7. Wear (LVDT): +/-2 mm, least count 1micron

## **IV.OPERATION PROCEDURE**

1. Connect the power input cable to 230V; 50Hz, and 5 Amps supply. Thoroughly clean specimen, remove burs from the circumference using emery paper.
2. Place the specimen pin between the jaws and adjust the height of the pin with respect to the wear disc using height adjustment block.

3. Set required track radius by moving the sliding plate graduated scale on base plate.
4. Open the software winducom 2006 by double clicking on the winducom software icon in the comp.
5. Place required weights on loading pan.
6. Set the speed and test duration on controller
7. Press the enter button in the PC window
8. The test stop automatically after the elapse of preset time or count and reading are directly save in the PC.

Above procedure is repeated for various load and sliding distance for test specimen.

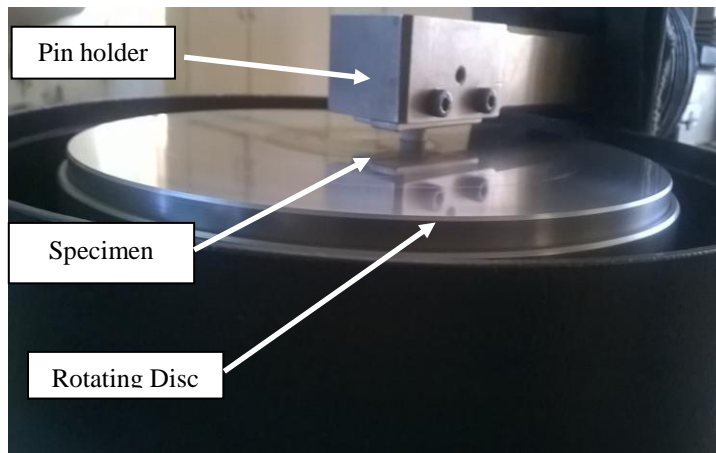


Fig2: Specimen with rotating disc

Table I: Position for PTFE composite materials

Material	Chemical configuration in Wt. %
I	30% Carbon filled PTFE
II	30% Bronze filled PTFE
III	30% Glass filled PTFE

### V. DESIGN OF EXPERIMENT

Design of experiment is used to determine the impact of factors on the response variable. With quantitative factors, which vary on a continuous scale we can obtain information about the variable's behavior even for factor levels that have not been experimentally determined. The Taguchi method is used to improve the quality of products and processes. Improved quality results when a higher level of performance is consistently obtained [7].

TableII: Allocation of level to the variable as applicable to pin on disc machine

Levels	Low	Medium	High
Load (kg)	3	4	5
Speed (rpm)	300	300	300
Sliding distance (mm)	30	40	50
Materials	PTFE+ 30% Carbon	PTFE+ 30% bronze	PTFE+ 30% glass

Table III: Allocation of level to the variable as applicable to virtually

Levels	Low	Medium	High
Load (kg) (A)	3	4	5
Velocity of sliding (m/s) (B)	0.94	1.2566	1.570

Sliding distance (mm) (C)	30	40	50
Code	-1	0	1

### VI.RESULT AND DISCUSSION

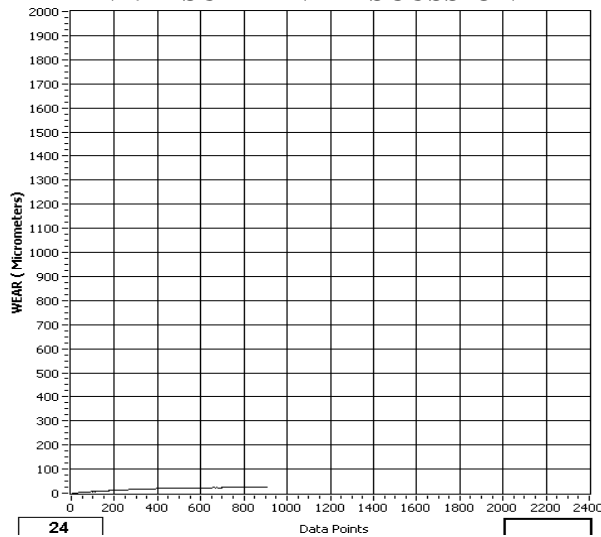


Fig3: Wear v/s Time

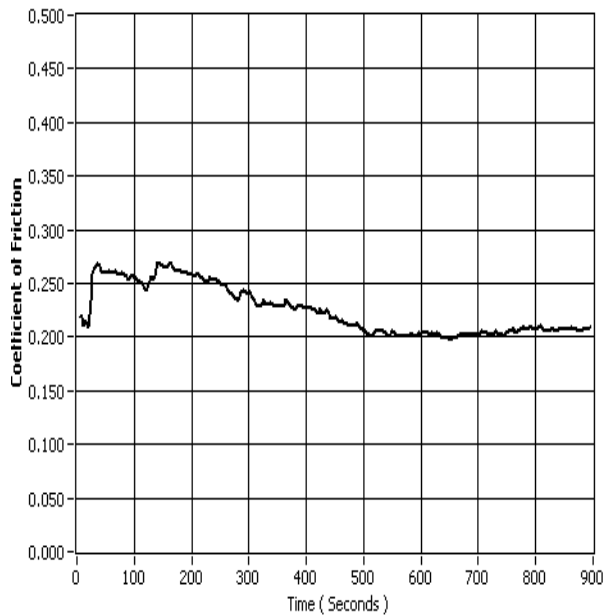


Fig4: Coefficient of friction v/s Time

The above graph shows the material of PTFE containing 30% carbon having low coefficient of friction as compared to PTFE containing 30% Bronze, and 30% glass but the wear is high i.e. 24 .

At 3kg load and sliding distance 40mm, under dry condition at room temperature for 15 min.

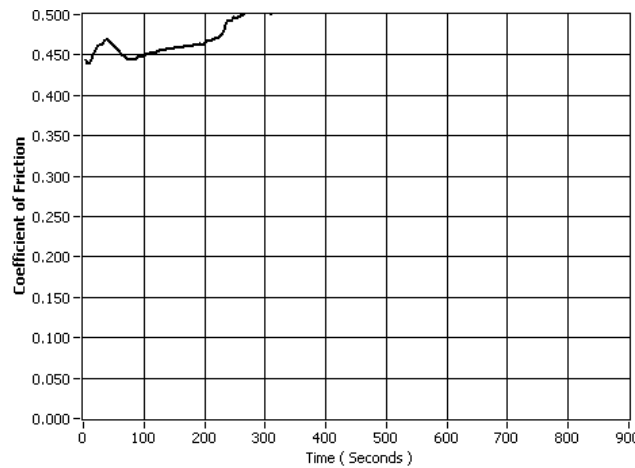


Fig 5: coefficient of friction v/s Time

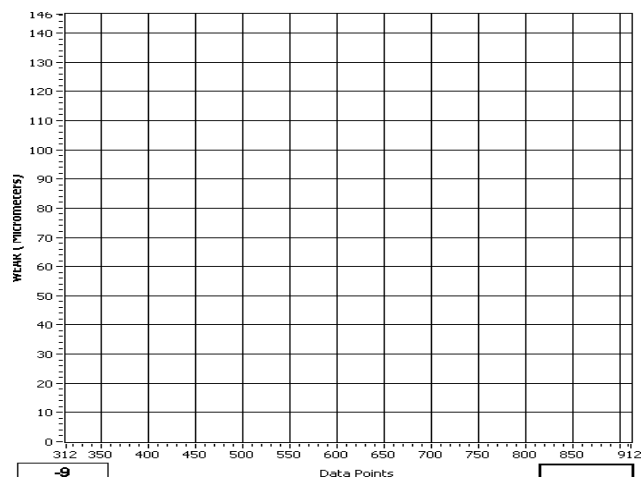


Fig 6: Wear v/s Time

The above graph shows coefficient of friction increases as shown in fig 5.w.r.t.time but wear is decreased as shown in fig 6.w.r.t.to time of material PTFE containing 30% Bronze under same operating condition but at 50mm sliding distance.

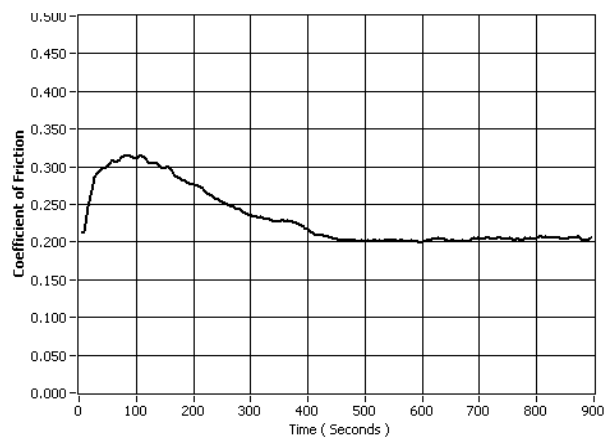


Fig 7: Coefficient of friction v/s Time

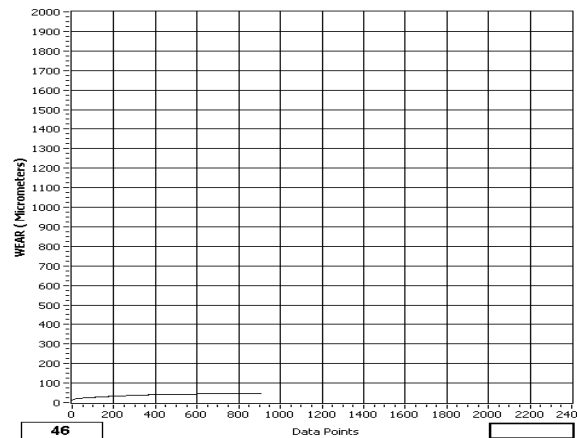


Fig8: Wear v/s Time

The above graph shows the material PTFE containing 30% glass having high wear i.e. 46 as compared to PTFE containing 30% carbon and 30% bronze also coefficient of friction increases and then decreases under similar operating condition. Further analysis will be done using 'design expert 9 software'.

### VII.CONCLUSION

From experimentation it is found that material I have high coefficient of friction than material II&III. Material II have low wear than material I&III. And the material III have high wear as compared to material I &II. Due to the addition of filler material in PTFE it is found that wear resistance increases.

### ACKNOWLEDGMENT

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