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Abrasive Wear Behavior of Organopolysiloxane

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***Abstract:** The objective of present work is to evaluate the abrasive wear of Organopolysiloxane by grinding it at different load at different RPM. In this research, a study of abrasive wear of Organopolysiloxane at various speed were given to analyze the possibility of wear. A review of abrasive wear behaviour of Organopolysiloxane using different wear rate speed has been discussed in this research. It mainly focuses on the varying wear condition while varying RPM. Wear is very important parameter which directly affects the life of a component. The goal of this study is to evaluate abrasive wear only.*
***Keywords**: Organopolysiloxane, Abrasive Wear, RPM*

I. INTRODUCTION

Organosilicon compounds are organometallic compounds containing carbon–silicon bonds. Organosilicon chemistry is the corresponding science of their preparation and properties. Most organosilicon compounds are similar to the ordinary organic compounds, being colourless, flammable, hydrophobic, and stable to air. Silicon carbide is an inorganic compound. An organopolysiloxane composition or, more particularly, to an organopolysiloxane composition comprising a fluorocarbon group-containing organopolysiloxane having a remarkably low surface energy and exhibiting excellent wettability and lubricity against various materials.

S. Vishvanathperumal [1] reported that the tensile strength, modulus, tear strength, abrasion resistance, hardness and crosslink density increased with the CB filler content in hybrid filler, reached the maximum value at 50 phr of high abrasion furnace carbon black. Morphological properties of composites were Organopolysiloxaneluated by scanning electron microscopy analysis. P. Sampathkumaran [2] conducted the research and the results showed that the wear volume loss is increased with increase in abrading distance and the specific wear rate decreased with increase in abrading distance/load. However, the presence of SiC particulate fillers in the G-E composites showed a promising trend. The worn surface features, when examined through scanning electron microscopy, show higher levels of broken glass fiber in G-E system compared to SiC- filled G-E composites.

Pramila Bai et. al. [3] reported that Si additions (4-24%Si) improved wear resistance of aluminium, no relationship between wear rate as a function of Si content was found. Wear rate increased linearly with applied pressure but was independent of sliding velocity. The value of the friction coefficient was found to be insensitive to applied pressure, Si content and sliding velocity. Liang Y. N. et. al. [4] reported that the MMCs containing SiC particles exhibit improved wear resistance. Particle size is one of the most important factors in determining wear of particulate-reinforced metal composites. However, it appears to be difficult to draw a fundamental conclusion from the reports about this problem.

R. Dasgupta et al [5] concluded in their study that the high stress wear behavior is dependent on the combination of a number of experimental factors. The behavior can be explained based on the material removal mechanism operating under a combination of experimental factors.

A regression analysis of the experimental data shows that the dependence is nonlinear. L.J. Yang et al [6] in their study found that the wear coefficient values obtained from different investigators can vary significantly up to a deviation of 1000% due to lack of a standard test method.

Higher wear coefficient values can be obtained when the wear tests are carried out within the transient wear regime, or with an excessive sliding distance in the steady-state wear regime. Basavarajappa S. and Chandramohan G [7] reported that the sliding distance has the highest effect on the dry sliding wear behavior of MMCs than that of the load and sliding speed. S.S. Mahapatra and Vedansh Chaturvedi [8] found that the hardness of the composite monotonically decreases as the fibre length increases but tensile strength first increases and then decreases as length of the fibre is increased. In contrary to common belief that hardness and tensile strength improve wear resistance, it has been observed that parameters encountered in wear process strongly influence wear resistance.

In future, the study can be extended to other natural fibres to find out the optimum fibre length. The abrasive wear behavior of chemically treated sugarcane fibre and aging effects of the fibre on abrasive behavior of the composite can be studied.

II. EXPERIMENTATION

Wear rate and wear mass were Organopolysiloxaneluated at different orientation of the specimen. The tests were conducted for seven different orientations namely 100 rpm, 150 rpm, 200 rpm. The wear mass of above said specimen Organopolysiloxaneluated at a constant time of 2min (120 sec). The following figure 1 shows the setup of Wear Test Rig.

Fig. 1 Setup for experiments

The aim of present work is to check the abrasive wear of abrasive of Organopolysiloxane at same orientation of the specimen but different applied loads. In this connection it is aimed to be carried out fabrication of single orientation pin on disc setup, selecting same materials for the desired test at different weight, studying the abrasive wear characteristics of the selected materials of the specimen, determining the abrasive wear characteristics at different applied loads and determining the abrasive wear characteristics at different applied RPM. The loads selected for present study are 5N, 10N and 15N.

The organopolysiloxane composition proposed is a blend of a conventional diorganopolysiloxane or a dimethylpolysiloxane oil and a limited amount of an (etherified) perfluoroalkyl group-containing organopolysiloxane such as those represented by the group of 1 to 14 carbon atoms or an etherified perfluoroalkyl group of 2 to 14 carbon atoms having at least one oxygen atom between two carbon atoms forming an ether linkage, R is a hydrogen atom or a monovalent hydrocarbon group having 1 to 10 carbon atoms, Y is a divalent organic group having 2 to 5 carbon atoms, the subscripts a and b are, each independently from the other, zero or a positive integer and the subscripts c and d are, each independently from the other, zero, 1, 2 or 3 with the proviso that at least one of the subscripts a, c and d is not zero. The following figure 2 shows the specimens on which the tests has to be performed.

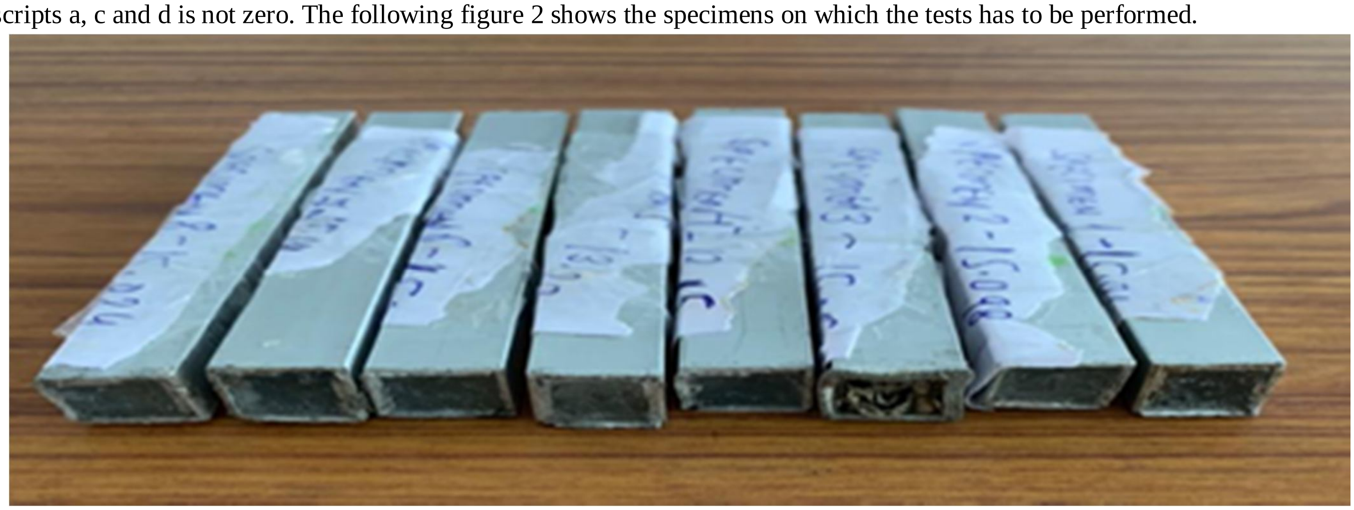


Fig. 2 Specimens

III.RESULTS AND DISCUSSION

A. Effect of Speed (RPM) on Abrasive Wear of Organopolysiloxane at Constant Load

As the wear studies were conducted against the abrasive media (grinding disc). The selection of applied load and the position of the specimen for wear studies were taken as three different loads. Five reading of wear were taken from three sets at different rpm. The result shows that as the speed (rpm) increases the wear rate of the specimen increases for a same load.

Table I: Wear Behavior Of Organopolysiloxane Different Sets At Different Angular Speed At 5n Load

Set No.1 (100 RPM, 5 N)			
TEST NO	MASS BEFORE TEST(gms)	MASS AFTER TEST(gms)	WEAR BY MASS (gms)
1	10.435	8.371	2.064
2	10.736	8.7	2.036
3	10.516	8.444	2.072
4	10.987	8.913	2.074
5	10.809	8.736	2.073
MEAN			2.063

Set No.2 (150 RPM, 5 N)			
TEST NO	MASS BEFORE TEST(gms)	MASS AFTER TEST(gms)	WEAR BY MASS (gms)
1	10.541	8.498	2.043
2	10.663	8.521	2.142
3	10.329	8.278	2.051
4	10.489	8.417	2.072
5	10.576	8.419	2.157
MEAN			2.093

Set No.3 (200 RPM, 5 N)			
TEST NO	MASS BEFORE TEST(gms)	MASS AFTER TEST(gms)	WEAR BY MASS (gms)
1	10.642	8.516	2.126
2	10.45	8.372	2.078
3	10.737	8.639	2.098
4	10.56	8.484	2.076
5	10.582	8.47	2.112
MEAN			2.098

Table Ii: Wear Behavior of Organopolysiloxane Different Sets at Different Angular Speed at 10N Load

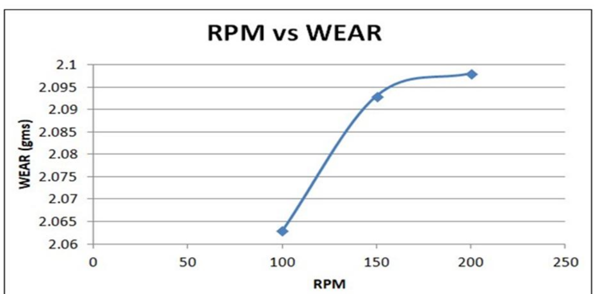
Set No.4 (100 RPM, 10 N)			
TEST NO	MASS BEFORE TEST(gms)	MASS AFTER TEST(gms)	WEAR BY MASS (gms)
1	10.651	8.534	2.117
2	10.569	8.504	2.065
3	10.362	8.231	2.131
4	10.956	8.817	2.139
5	10.762	8.628	2.134
MEAN			2.117

Set No.5 (150 RPM, 10 N)			
TEST NO	MASS BEFORE TEST(gms)	MASS AFTER TEST(gms)	WEAR BY MASS (gms)
1	10.486	8.409	2.077
2	10.078	8.815	2.263
3	10.446	8.352	2.094
4	10.39	8.253	2.137
5	10.442	8.143	2.299
MEAN			2.174

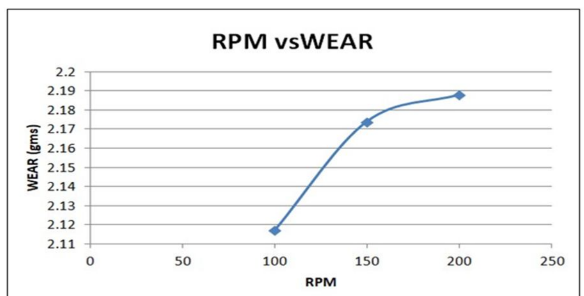
Set No.6 (200 RPM, 10 N)			
TEST NO	MASS BEFORE TEST(gms)	MASS AFTER TEST(gms)	WEAR BY MASS (gms)
1	10.516	8.271	2.245
2	10.486	8.339	2.15
3	10.45	8.263	2.187
4	10.987	8.842	2.145
5	10.541	8.327	2.214
MEAN			2.188

Table III: Wear Behavior of Organopolysiloxane Different Sets at Different Angular Speed At 15N Load

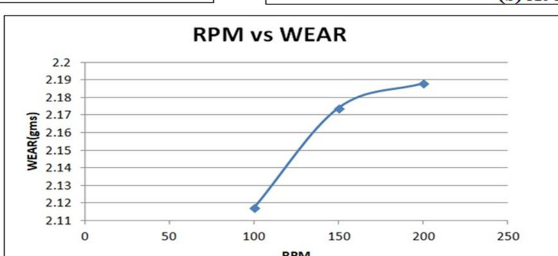
Set No.7 (100 RPM, 15 N)			
TEST NO	MASS BEFORE TEST(gms)	MASS AFTER TEST(gms)	WEAR BY MASS (gms)
1	10.526	8.34	2.186
2	10.72	8.616	2.104
3	10.504	8.294	2.21
4	10.97	8.755	2.215
5	10.78	8.567	2.213
MEAN			2.185
Set No.8 (150 RPM, 15 N)			
TEST NO	MASS BEFORE TEST(gms)	MASS AFTER TEST(gms)	WEAR BY MASS (gms)
1	10.445	8.32	2.125
2	10.661	8.246	2.415
3	10.328	8.18	2.148
4	10.483	8.366	2.117
5	10.572	8.108	2.464
MEAN			2.253
Set No.9 (200 RPM, 15 N)			
TEST NO	MASS BEFORE TEST(gms)	MASS AFTER TEST(gms)	WEAR BY MASS (gms)
1	10.648	8.278	2.37
2	10.459	8.234	2.225
3	10.719	8.437	2.282
4	10.547	8.332	2.215
5	10.728	8.403	2.325
MEAN			2.283



(a) At 5 N Load



(b) At 10 N Load



(c) At 15 N Load

Fig. 3 Plots for RPM vs Wear (a) at 5N load (b) at 10N load (c) at 15N load

The figure 3 shows the plots for RPM vs Wear. The graph (a) shows that the wear loss increases while RPM increases. The graph is not linear in nature at 5N load. In graph (b), the wear loss increases while RPM increases. This graph is also not linear in nature at 10N load. The graph (c) shows that the wear loss increases while RPM increases. The graph is too non-linear in nature. In this graph, wear loss is more as compare to graph (a) and graph (b).

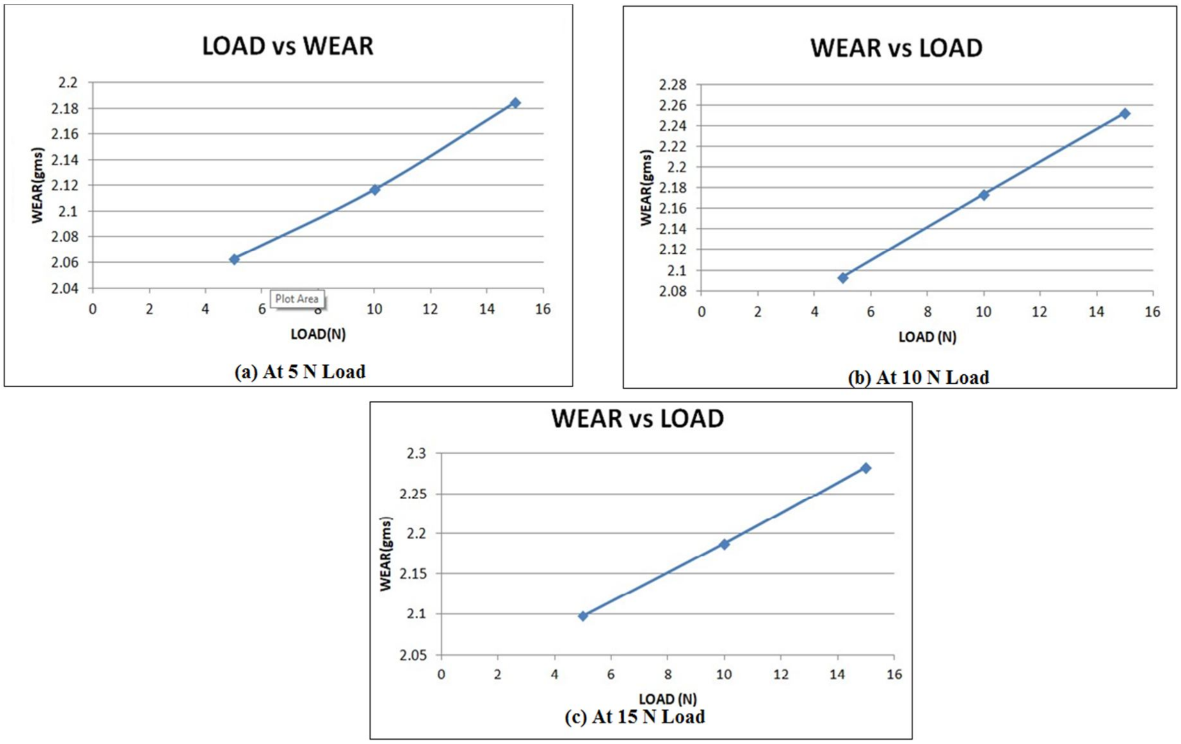


Fig. 4 Plots for Wear vs Load (a) at 5N load (b) at 10N load (c) at 15N load

The above graph shows plot between Wear and Load. At 5N load in plot (a), the wear loss increases while load increases. The graph is linear in nature, this shows linear relationship between load and wear. At 10N load in graph (b), the wear loss increases while load increases. The graph too is linear in nature and shows linear relationship between load and wear. In graph (c) at 15N load, the wear loss increases while load increases. The graph is also linear in nature and shows linear relationship between load and wear. In this graph wear loss is more as compare to graph (a) and graph (b).

IV. CONCLUSIONS

It is concluded from the above discussion that wear is function of applied load. Initially, it was understood that wear depends upon applied load, surface parameters and mechanical properties such as hardness, toughness etc. Thus it can be concluded that:

A. There is a linear relationship between wear and load
B. The wear loss increases while load increases. Wear loss is more at 15 N load as compare to 5N and 10N load.
C. The wear loss increases while RPM increases.
D. The wear loss in first minute is more as compare to last minute while increasing the RPM.

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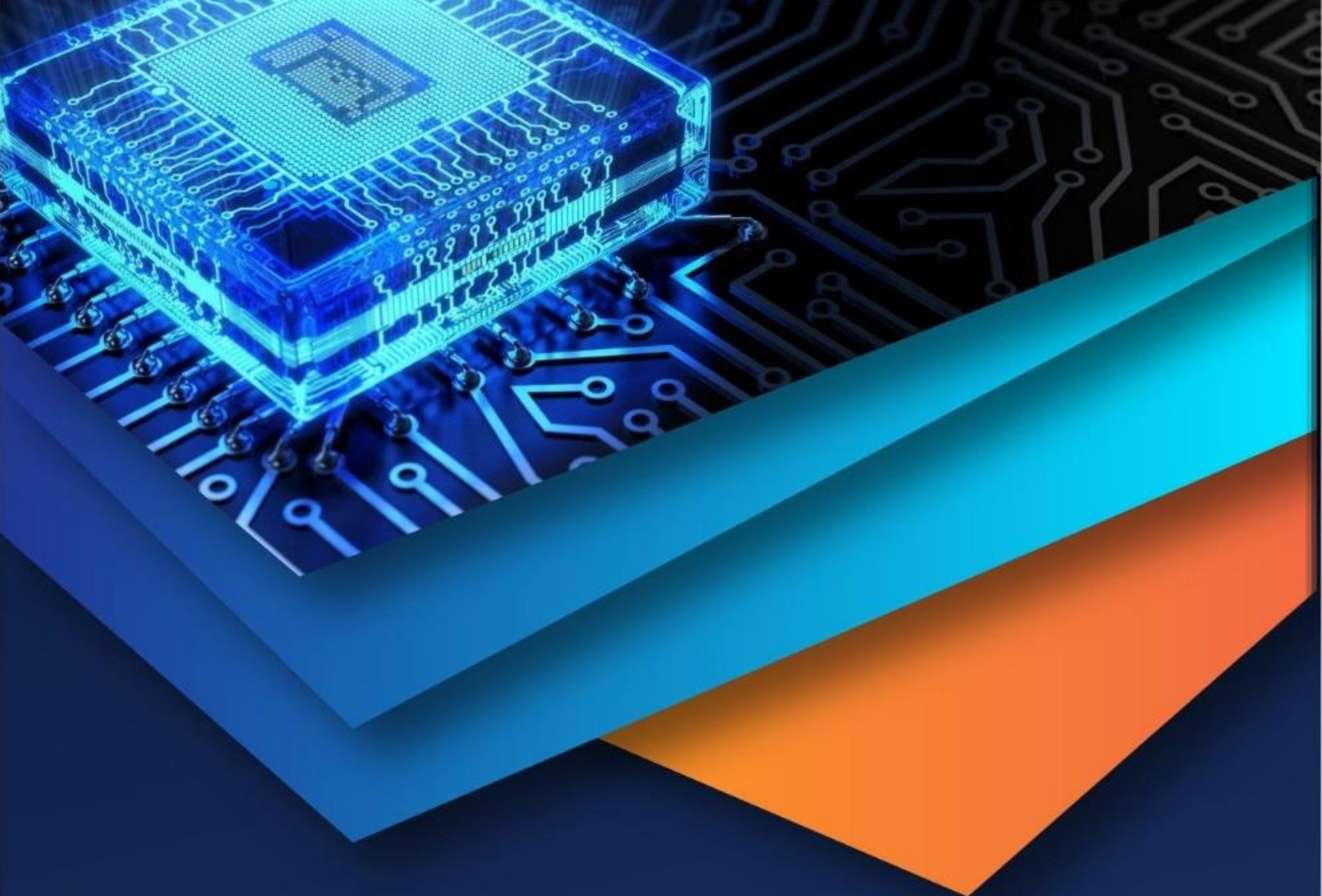

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