Improvement in Wear and Friction Properties of Polyphenylene-Sulphide Composite with 30% Carbon Fiber

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Abstract— The Objective of this dissertation work was to study the effect of filler material on Mechanical Properties of polyphenelene sulphide Composites. For this purpose, carbon fibre filler materials were selected based on their end applications. The fillers used are carbon fibre. The composition selected was PPS + 30% Carbon Fiber Fillers. The mechanical test was carried out on pin on disc apparatus Tribometer. The friction and wear Test gave the results for frictional force, coefficient of friction and wear. The results indicated that carbon Filled Composites showed best results for friction and wear whereas frictional force, coefficient of friction and wear results were good for Carbon filled ones. The specimens were tested during three intervals of time i.e. 15, 30 & 45 minutes. The results concluded that carbon filled composites showed greater strength. Micro-structure Analysis was carried out after manufacturing the specimen.

Key words: Carbon Fibre, Polyphenelene Sulphide, Micro-Structures

I. INTRODUCTION

Composite Materials are combination of two materials in which one of the materials, called the reinforcing phase, which is in the form of fiber sheets or particles and are embedded in the other material called the matrix phase. The primary functions of this matrix are to transfer stresses between the reinforcing fibers or particles and to protect them from mechanical and environmental damage whereas the presence of fibers or particles in a composite improves its mechanical properties such as friction, wear etc. Carbon filler composites have been of significant importance to engineering community for many years. Components made of epoxy based materials have provided outstanding mechanical, thermal and electrical properties. Using an additional phase (ex- inorganic fillers) to improve the properties of epoxy resins has become a common practice.

II. SAMPLE PREPARATION FOR WEAR TEST DISC

- Disc size - The disc of diameter 165 mm and thickness 8 mm is selected as the rotating counter surface. The tungsten carbide coated En 8 steel is to be select. The disc having four equidistance holes at 145 mm pitch circle diameter.
- Pin Size - The specimens for wear test were prepared of diameter 3-12 mm and height 30 mm. For hardness test specimens were prepared of diameter 10 mm and height 10 mm.

Specimen	Compositions
C1	PPS (100%wt)
C2	PPS + 30% Carbon Fiber

Table 1: Designation of Composites

III. OPERATING PARAMETERS WERE SELECTED FOR THE STUDIES.

Operating parameters were selected for the studies. (Select from the Catalog Polymer Ball Bearing from SKF)

- Loads applied: 110 N
- Temperature: at room temperature.
- Sliding velocity: 0.71m/s and 1.09 m/s

$V = (\pi DN) / 60$
where, D = Diameter of shaft.
N = Bearing speed in rpm
$V = (\pi \times 0.012 \times 1140) / 60$
V = 0.7 m/s

IV. EXPERIMENTAL

Fig. 1: Experimental Setup for Friction and Wear test (Pin on Disc Apparatus)

V. OBSERVATIONS

Sr. No.	Material	Frictional force (N)	Wear (µm)	Coeffici1ent of Friction(µ)
1	PPS	22.24	88.07	0.21
2	PPS+ 30%CF	15.46	41.18	0.13

Table 2: Wear, Coefficient of Friction, Normal Load at 110 N, Velocity 0.7 m/s at Room Temperature

VI. RESULT AND DISCUSSION

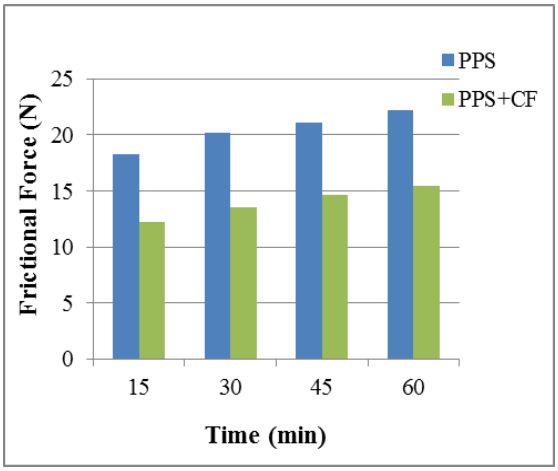

Fig. 2: Frictional Force Vs Time for Load 110 N, Velocity 0.71 m/s.

Above graph show the frictional force Vs time, in which friction and wear test is taken up to one hour then after 15 minute interval frictional force is notice that first interval frictional force is 18 N for pure PPS same time frictional force for PPS + 30% CF is 12 N. Finally after completing one hour frictional force is 22.24 N for pure PPS and 15.46 N frictional force with adding additional 30% CF.

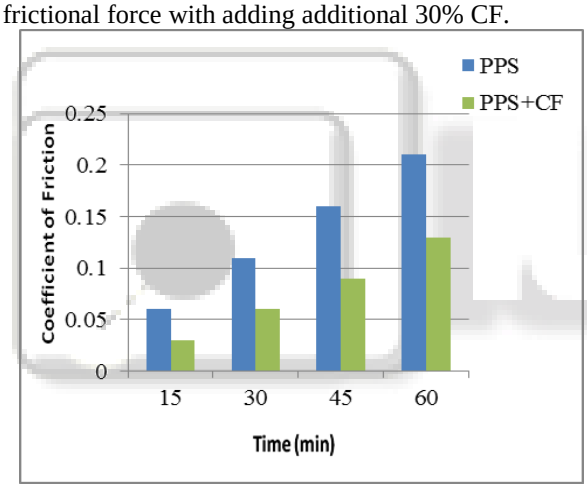

Fig. 3: Coefficient of Friction Vs Time for Load 110 N, Velocity 0.71 m/s.

Above graph show that Coefficient of Friction Vs Time after completing one hour wear value for pure PPS is show the 0.21 but with additional CF Coefficient of friction show 0.13 it means by adding 30% Carbon Fiber increases the properties of PPS.

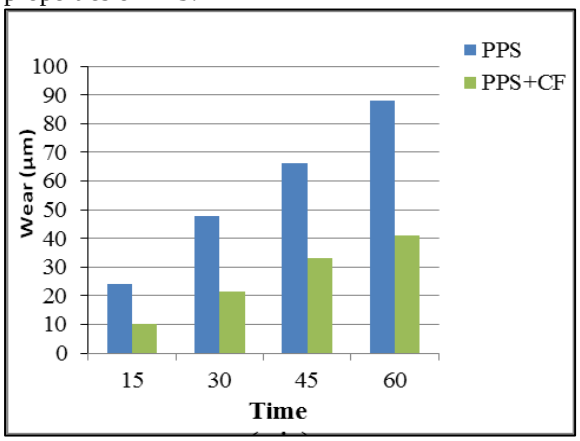

Fig. 4: Wear Vs Time for Load at 110 N, Velocity 0.71 m/s.

Above graph show that wear Vs Time after completing one hour wear value for pure PPS is show the 88.07 µ but with additional CF it means in pure PPS with filler material is carbon fiber show 41.18 µ it means by adding 30% Carbon Fiber increases the properties of PPS.

VII. CONCLUSION

- PPS composites under experimental investigation register the stability in wear loss with time after the faster initial wear.
- For the selected range of normal load and sliding velocity, the wear increases with increase in load.
- The coefficient of friction decreases with increase in load.
- At constant load the coefficient of friction is slightly increases with increase in sliding velocity.
- For the specific range of load and speed explored in this study, the load has stronger affect on the wear behaviour of PPS and its composites than the sliding velocity.
- Among the all PPS composites under experimental investigation due to friction and wear mechanism the lowest wear loss is observed for the composite of PPS composite reinforced with 30 % Carbon fiber particles by weight for all the values of loads and sliding velocity.

It is observed that the addition of Carbon filler to Pure PPS improves the wear resistance significantly as compared to pure (unfilled) PPS.

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