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Modelling, Analysis and Wear Test of Carbon Fiber with Sansevieria Trifasciata Fiber Reinforced Polymer Hybrid Composite

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Abstract
A pin-on-disk wear testing machine was used to analysis wear properties. The specimen pin was rotated against a hardened and polished carbon steel disk EN35. All tests were conducted at room temperature. During the test, the wear, coefficient of friction and friction force was recorded with plotter. Pin on disc wear test used for wear testing and friction tabulated the data of frictional force and Coefficient of friction, sliding distance.
We conducted Wear test for the specimens which is having different percentages of C.F. and S.T. The percentages of C.F. & S.T.F. The Wear test was conducted at 500 rpm and 700 rpm speeds. In each speed we have taken load of 15 N. In this wear test, properties like sliding distance (mm), frictional force (MPa), pressure contact (MPa) and temperature (^{0}C) were observed and tabulated. The optimal fiber length is 60 mm, and the ideal fiber weight percentage is 50% Epoxy + 30% CF + 20% STF% wt and 50% Epoxy + 35% CF + 15% STF% wt.The results are given in Ansys was used to analyse the wear properties.

Keywords: Wear Test, Ansys, Modelling, Composite Materials, Carbon Fiber, STF.

1. INTRODUCTION

This chapter goes into Research on composites consisting only of sansevieria trifasciata fiber and hybrid composites comprising both sansevieria trifasciata and carbon fiber are carried out using wear properties [1]. Composites using carbon fiber (CF) [2] composed of hybrid polymers. The great length regarding the many types of composite materials, with a focus on polymer matrix composites. Sansevieria trifasciata, the snake plant, is well recognized for its capacity to both create and absorb vast volumes of oxygen and carbon dioxide. It can often be accessed in remotelocations. The cross-sectional location of carbon fiber, which is between 5 and 10 micrometers, may offer better adaptability. Carbon fiber and graphite are blended together.

The extensive usage of artificial fibers in automobiles and aerospace, such as carbon and ST [3] fiber, ensures their excellent overall functionality. This article discusses the wear properties of hybrid carbon fiber (CF) plastic composites made of Sansevieria trifasciata (STF) fibers, as well as the results of the wear tests. wear tests were used to ascertain the composite sample's mechanical characteristics [5]. It isforced to ask for circumstances that, in actuality, depend on oil. Depleting petroleum reserves,volatile crude oil prices, disposal concerns, and synthetic toxins have all raised questions about potential solutions (Koronis et al., 2011). In the case of randomly oriented composites, natural fibers with optimal fiber percentage and weight fractions [6, 7 and 8]. In fact, applications involving heatsurfaces use carbon fiber [9]. Fibres 2 are used in conjunction with kenaf, flax, hemp, and ramie to produce fiber. Composites [10] are in high demand for architectural needs.

Together with two different materials, such as Sansevieria trifasciata, carbon fiber, and matrix, complex components [12] are made. In reality, compound [13] goods weigh substantially less.Laminated flooring with different percentage structures and directions is made of composite materials.

The carbon fibers have a cross- sectional location of 5–10 microns and are more flexible. Graphite and carbon fiber are mixedtogether. In fact, thermal surface applications use carbon fibers [14].

Carbon fibres as well as Sansevieria Trifasciata fibres reinforced with proven plastic 4 compounds to drive wear buildings such as frictional force, sliding distence and Coefficient of friction against high temperature damage [15] Composites have improved commercial properties and construction techniques such as traction, impact, stiffness and flexural characteristics as a result of the hybridization of artificial and natural yarns. The transverse location of carbon fibres is actually 5 to 10 microns.

Figure 1: Sansevieria Trifasciata plant (snake plant) Figure 2: Sansevieria Trifasciata fibre

It is well known that carbon fiber has greater strength, more thermic conductivity, and greaterdurability. Carbon fiber is a material that is long and thin, usually consisting of carbon fiber atoms in longitudinal dimensions of 0.0002-0.0004 in and 0.005-0.010 mm in diameter. Carbon fibers that are typically 1 to 5 µmin size. Carbon fiber fibers with sizes between 6 and 10 µm are usedas an enhancing product in polyester and epoxy materials to create high-tightness compositesbecause they have high flexible moduli and strengths. Actually, carbon fibers are a long, thin substance made up of carbon fiber atoms that have longitudinal diameters of 0.005-0.010 mm and 0.0002-0.0004 mm. The support could be manufactured using materials such carbon fiber, glass, boron, and aramid. [2]

Figure 3: Carbon fibre mat Figure 4: Epoxy and Hardener

Composites consist of two or more components, one of which is a filler or reinforcement consisting of long, tension fibers or even a particle product, and the other of which is a binder,source, or resin that holds the filler in place. [16] Synthetic and natural fibers are the two typesof fibers that are genuinely used as encouragement. [17] According to some descriptions, carbon fiber contains at least 90% carbon that is obtained through the carefully regulated pyrolysis of perfect fibers.

Higher elastic moduli and durability are possessed by carbon fiber fibers with diameters in the range of 6–10. These fibers are utilized as an enhancer in epoxy and rayon materials to createcomposites with increased stiffness. Young's modulus is 125–181 Gpa, and the carbon fiber exhibits excellent heat resistance, chemical resistance, compressive strength, hardness, and tensile durability (4127 J/m^3). [18]

[19] Because oil serves as the primary raw material for the production of carbon fiber and other man-made fibers, the high overall efficiency of these materials.

❖ APPLICATIONS AND ADVANTAGES OF HYBRID COMPOUNDS S.T& C.F.

When plants are grown inside, with a maximum temperature of 65 to 80 °F.For the source, plant nutrients that include N-P-K (nitrogen-phosphorus-potassium in the blood) are fed to the plants in a 7:4:10 ratio in the spring. The Snake plant is one of 15 types of plants that can absorb pollutants from the air, according to a NASA clean air research.

2. MATERIALS AND METHODS

A component made of carbon fiber (CF) from Go, Chennai's eco-friendly products. The carbon fiber specification includes directions for 90 ^{0} C as well as HS 12K on a 0^0 C trajectory. ASTM D 1777 specifies a density of 0.45 mm for carbon fiber, while ASTM D 3776 specifies a distanceof 1005 mm. The ASTM D 3801 value for carbon fiber is 419 g/mm^2, and the thread size is 7µ. In actuality, carbon fiber has an adhesion advantage of 3450 MPa.

In reality, the carbon-fibre-reinforced polymer is a lightweight, extremely durable plastic that is reinforced with carbon fibers.

Epoxy products and hardeners are LY 556, HY951. The transverse composite laminates actuallyhad 8 levels. A hybrid composite with randomly oriented carbon fibres as well as fibres of sansevieria trifasciata within the plastic matrix has been prepared. Carbon fibre (CF) purchased from Go Chennai Green Products. The crossover complex test method involves 8 layers along with epoxy and hardener. The dimensions of the samples are 63X12X3. In the impact test, the sample size was actually 63.5 X12.7 X3. In the tensile test, the sample sizes are 165X13X3.The Sansevieria Trifasciata, which is now being reviewed here, is made of carbon fiber. Hindupur, Anantapuramu District (A.P.), India is the source of S T. In actuality, the S.T. fiber comes from S.T. Cut leaves spend approximately a month breaking down in water that has been agitated.

In actuality, the default quantity of LY-556, HY-951 tampers with the 10:1 ratio. In reality,all intricate structures are created by laminating wood forms. The product is first cured for 24 hours at room temperature before being exposed to an 8-hourcuring period at 600 °C. There are eight fully blended layers of epoxy and hardener that makeup the complicated laminates Carbon Fiber and Sansevieria Trifasciata. In actuality, the laminates' total typical fullness measured 3 mm. In actuality, hybrid composites with an areaweight of 380g/m2 have been created, beginning with the STRP structure and altering the carbon fiber layer.

❖ MATERIALS USED

The different types of materials used to treat all the compounds under investigation are presented below:

❖ MATRIX MATERIAL

The unsaturated isophthalic polymer (USP) resin used in this study has a density of 1.2 g/cc and a viscosity of 12,000 MPa. It is sourced from Green Products, Chennai, India. Dibasic organic acidsand polyhydric alcohols react to generate chemically double bonds, which are commonly seenin unsaturated polymer resin.

❖ FIBRE MATERIAL

In the present work, Sansevieria trifasciata (ST) fibre has been used as the reinforcing materialin all the composites. Carbon fibre (CF) is used for studying the effect of hybridization alongwith sansevieria trifasciata fibre. The chemical properties of ST and CF used in this investigation are shown in Table 1.Chemical properties of fibre as referred and also procured.

Table 1: FIBER PROPERTIES

Properties / **Fibre**	**Cellulose content (Wt. %)**	**Lignin content (Wt. %)**	**Wax content (Wt. %)**	**Moisture content (Wt. %)**	**TOTAL**
STF	79.7	3.8	0.09	3.08	86.67

❖ FABRICATION OF COMPOSITES

The curing reaction is started by using the unsaturated polymer epoxy resin grade LY556 and hardener HY951 as a matrix(10 ml of hardener was taken for every 100 g of epoxy resin). Figure 1 displays the equipment used in compression moulding). The mould is squeezed by supplying a curing pressure of 1000 kg onceit is placed in the machine. Figure 2 displays the specimens with the fabrication of % sansevieria trifasciata and carbon fiber.

Figure 5: Laminate preparations with Compression moulding equipment, Figure 6: wear test specimens

2.1 WEAR ANALYSIS

A pin-on-disk wear testing machine was used to analysis wear properties. The specimen pin was rotated

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against a hardened and polished carbon steel disk EN35. All tests were conducted at room temperature. During the test, the wear, coefficient of friction and friction force was recorded with plotter. Pin on disc wear test used for wear testing and friction tabulated the data of frictional force and Coefficient of friction, volume of wear. We conducted Wear test for the specimens which is having different percentages of C.F. and S.T. The percentages of C.F. & S.T.F.

We conducted Wear test for the specimens which is having different percentages of C.F. and S.T. The percentages of C.F. & S.T.F. The Wear test was conducted at 500 rpm and 700 rpm speeds. In each speed we have taken load of 15 N. In this wear test, properties like sliding distance (mm), frictional force (MPa), pressure contact (MPa) and temperature (^{0}C) were observed and tabulated. The optimal fibre length is 60 mm, and the ideal fibre weight percentage is 50% Epoxy + 30% CF + 20% STF% wt and 50% Epoxy + 35% CF + 15% STF% wt.The Frictional Coefficient is 0.41

2.2 SUMMARY

This chapter presents:

- The materials used for the experiments are discussed.
- Details of the production and characterization of composites.
- Description of the wear test procedures.
- The next chapter discusses the effect of fibre percentage and weight on the mechanical properties and Analysis of wear Properties using Ansys Work Bench Tool of fibre- reinforced sansevieria trifasciata polymer composites.

3. RESULTS & DISCUSSION

This chapter discusses the wear properties of fibre-reinforced sansevieria trifasciata polymer composites. The interpretation of the results and the comparison between the different composite samples are also presented. The Frictional Coefficient is 0.75. The figure 7 represents for pin, disc and specimen geometry in ansys 19.0. Table 2. Details of mechanical properties of composites with varying wt. percentageof fibre content at optimum fibre percentage.

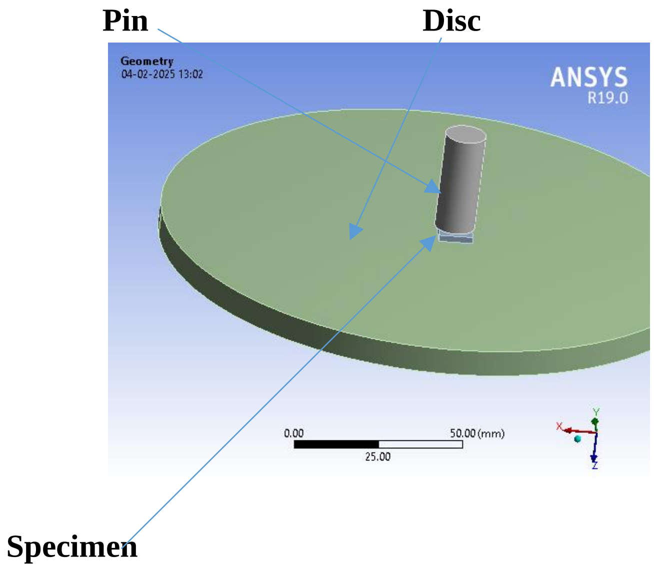

Fig 7: Geometry for Pin, Disc and Specimen

Table 2: MATERIAL PROPERTIES

	Young's Modulus		Poisson's Ratio	Density(Kgmm^3)
EN35	200000 **MPa**	200 Gpa	0.3	7850
50% epoxy + 30% CF+ 20%STF	181000 **MPa**	181 Gpa	0.15	1.02

50% epoxy + 35% CF+ 15%STF	181000 **MPa**	181 Gpa	0.15	1.312

The figures 8,9,10 represents for pressure contact at 15 N, speed 500 rpm with the compostion of 50% epoxy + 30% CF+ 20%STF with the frictional coefficient is 0.75.

I) 50% epoxy + 30% CF+ 20%STF

i) 500rpm, 15N

1) Pressure at Contact

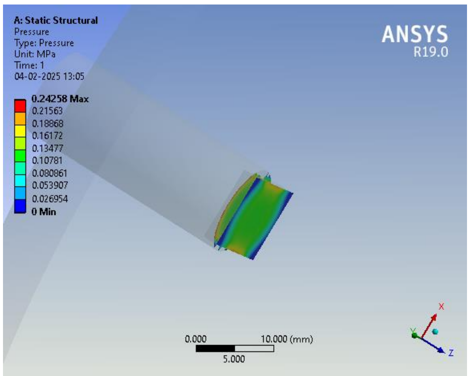

Fig 8: Pressure contact at 500 rpm, 15 N - 50% epoxy + 30% CF+ 20%STF

2) Sliding Distance

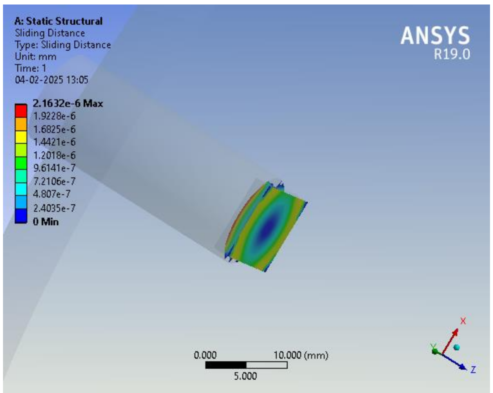

Fig 9: Sliding Distance at 500 rpm, 15 N 15 N - 50% epoxy + 30% CF+ 20%STF

3) Frictional Stress

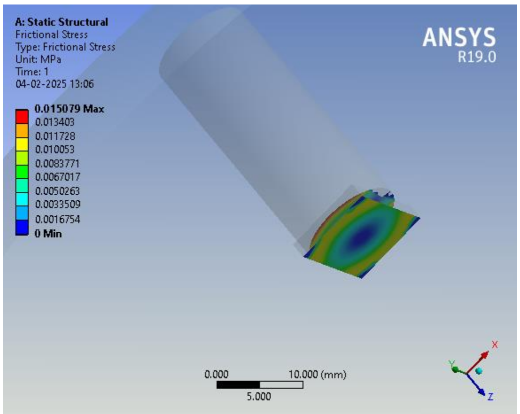

Fig 10: Frictional Stress at 500 rpm, 15 N-15 N - 50% epoxy + 30% CF+ 20%STF

The table 3 represents the wear test properties are like Pressure contact, Sliding distance and frictional stress at 500 rpm, 15 N and the 50% epoxy + 30% CF+ 20%STF.

Table 3: Pressure contact, Sliding distance and frictional stress at 500 rpm, 15 N-50% epoxy + 30% CF+ 20%STF

Si. No.	Pressure at contact (MPa)	Sliding Distance (mm)	Frictional stress (MPa)
1	0	0	0
2	0.026954	2.4035 e-7	0.0016754
3	0.053907	4.807 e-7	0.0033509
4	0.080861	7.2106 e-7	0.0050263
5	0.10781	9.6141 e-7	0.0067017
6	0.13477	1.2018 e-6	0.0083771
7	0.16172	1.4421 e-6	0.010053
8	0.18868	1.6825 e-6	0.011728
9	0.21563	1.9228 e-6	0.013403
10	0.24258	2.1632 e-6	0.015079

ii) 700rpm, 15N

The figures 11, 12, 13 represents for pressure contact at 15 N, speed 700 rpm with the composition of 50% epoxy + 30% CF+20%STF.

1) Pressure at Contact

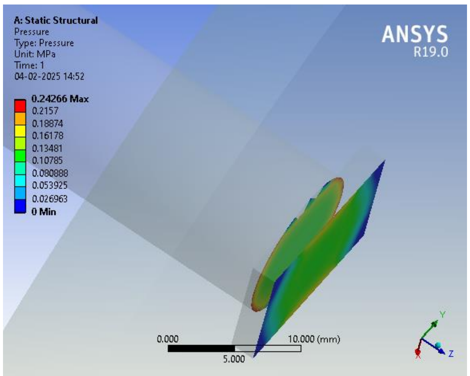

Fig 11: Pressure contact at 700 rpm, 15 N - 50% epoxy + 30% CF+ 20%STF

2) Sliding Distance

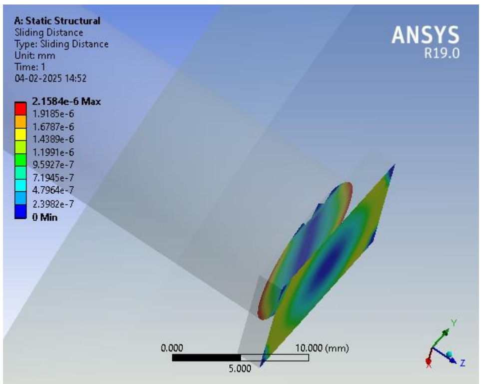

Fig 12: Sliding Distance at 700 rpm, 15 N - 50% epoxy + 30% CF+ 20%STF

3) Frictional Stress

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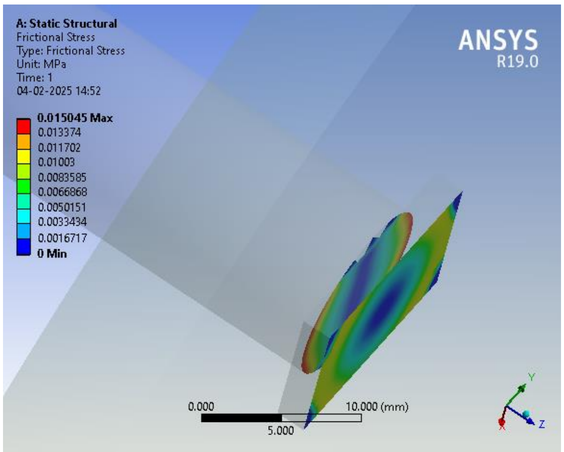

Fig 13: Frictional Stress at 700 rpm, 15 N - 50% epoxy + 30% CF+ 20%STF

The table 4 represents the wear test properties are like Pressure contact, Sliding distance and frictional stress at 700 rpm, 15 N and the 50% epoxy + 30% CF+ 20%STF.

Table 4: Pressure contact, Sliding distance and frictional stress at 700 rpm, 15 N- 50% epoxy + 30% CF+ 20%STF

Si. No.	Pressure at contact (MPa)	Sliding Distance (mm)	Frictional stress (MPa)
1	0	0	0
2	0.026963	2.3982 e-7	0.0016717
3	0.053925	4.7964 e-7	0.0033454
4	0.080888	7.1945 e-7	0.0050151
5	0.10785	9.5927 e-7	0.0066868
6	0.13481	1.1991 e-6	0.0083585
7	0.16178	1.4389 e-6	0.01003
8	0.18874	1.6787 e-6	0.011702
9	0.2157	1.9185 e-6	0.013374
10	0.24266	2.1584 e-6	0.015045

The table 5 represents the wear test properties are like Pressure contact, Sliding distance and frictional stress comparison between at 500 rpm, 700 rpm in 15 N and the 50% epoxy + 30% CF+ 20%STF.

Table 5: Comparison between Pressure contact, Sliding distance and frictional stress at 500 rpm & 700 rpm - 15 N with 50% epoxy + 30% CF+ 20%STF

Si. No	Static structural	500 rpm	700 rpm
1	Pressure at Contact (MPa)	0, 0.026954 to 0.24258	0,0.026963 to 0.24266
2	Sliding Distance (mm)	0, 2.4035 e-7 to 2.1632 e-6	0,2.3982 e-7 to 2.1584 e-6
3	Frictional Stress (MPa)	0, 0.0016754 to 0.015079	0, 0.0016717 to 0.015045

The table 6 represents the wear test properties are like Pressure contact initial and final results comparison between at 500 rpm and 700 rpm - 15 N in the 50% epoxy + 30% CF+ 20%STF.

Table 6: Comparison between Pressure contact 500 rpm & 700 rpm-15 N 50% epoxy + 30% CF+ 20%STF

Si. No	Static Structural	Pressure at Contact (MPa)
1	500 rpm initial	0.02695 or 26.65 KPa
2	500 rpm final	0.24258 or 242.58 KPa
3	700 rpm initial	0.02696 or 26.96 KPa
4	700 rpm final	0.24266 or 242.66 KPa

The figure 14 represents the initial and final results shows in pressure contact at 15 N, speed 500 rpm and 700 rpm and the 50% epoxy + 30% CF+ 20%STF

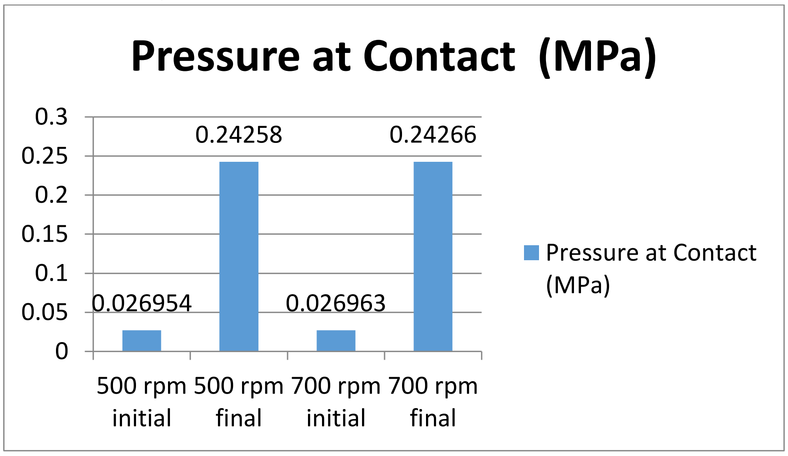

Fig 14: Comparison between Pressure contact 500 rpm & 700 rpm-15 N 50% epoxy + 30% CF+ 20%STF

The table 7 represents the wear test properties are like Frictional Stress (MPa) initial and final results comparison between at 500 rpm and 700 rpm - 15 N in the 50% epoxy + 30% CF+ 20%STF.

Table 7: Comparison between Frictional Stress 500 rpm & 700 rpm-5 N 50% epoxy + 30% CF+ 20%STF

Si. No	Static Structural	Frictional Stress (MPa)
1	500 rpm initial	0.00168 or 1.68 KPa
2	500 rpm final	0.01508 or 15.08 KPa
3	700 rpm initial	0.00167 or 1.67 KPa
4	700 rpm final	0.01505 or 15.05 KPa

The figure 15 represents the initial and final results shows in frictional stress at 15 N, speed 500 rpm and 700 rpm and the 50% epoxy + 30% CF+ 20%STF

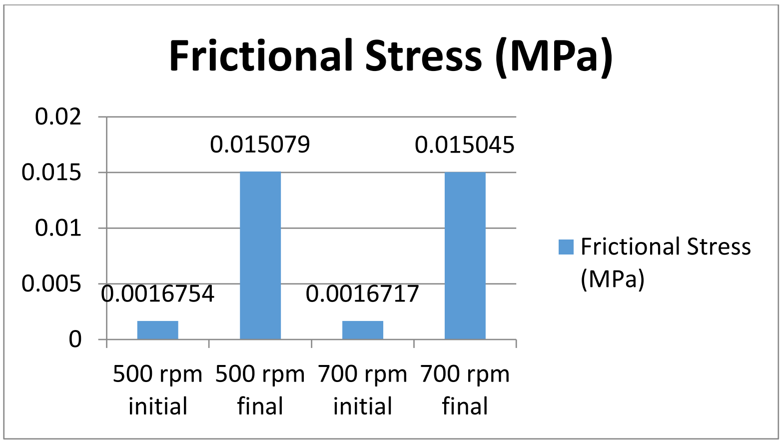

Fig 15: Comparison between Frictional Stress at 500 rpm & 700 rpm, 15 N 50% epoxy + 30% CF+ 20%STF

The table 8 represents the wear test properties are like Sliding Distance (mm) initial and final results comparison between at 500 rpm and 700 rpm - 15 N in the 50% epoxy + 30% CF+ 20%STF.

Table 8: Comparison between Sliding Distance (mm) at 500 rpm & 700 rpm -15 N 50% epoxy + 30% CF+ 20%STF

Si. No	Static Structural	Sliding Distance (mm)
1	500 rpm initial	2.4035
2	500 rpm final	2.1632
3	700 rpm initial	2.3982
4	700 rpm final	2.1584

The figure 16 represents the initial and final results shows in sliding distance at 15 N, speed 500 rpm and 700 rpm and the 50% epoxy + 30% CF+ 20%STF

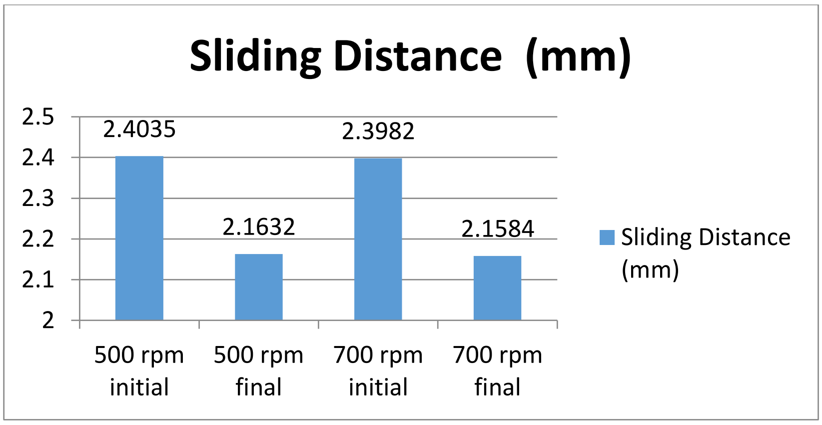

Fig 16: Comparison between Frictional Stress at 500 rpm & 700 rpm-15 N 50% epoxy + 30% CF+ 20%STF

The figures 17, 18, 19 represents for pressure contact at 15 N, speed 500 rpm with the compotion of 50% epoxy+ 35% CF+ 15%STF with the frictional coefficient is 0.41.

II) 50% epoxy + 35% CF+ 15%STF

i) 500rpm, 15N

1) Pressure at Contact

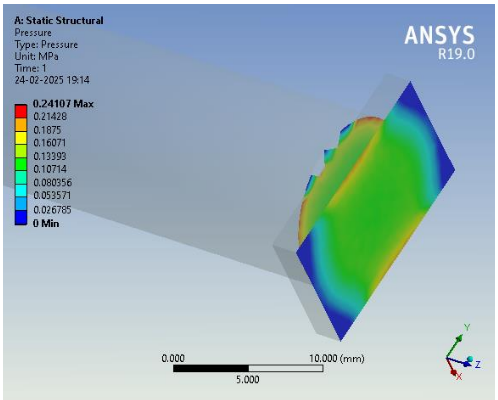

Fig 17: Pressure at Contact at 500 rpm, 15 N - 50% epoxy + 35% CF+ 15%STF

2) Sliding Distance

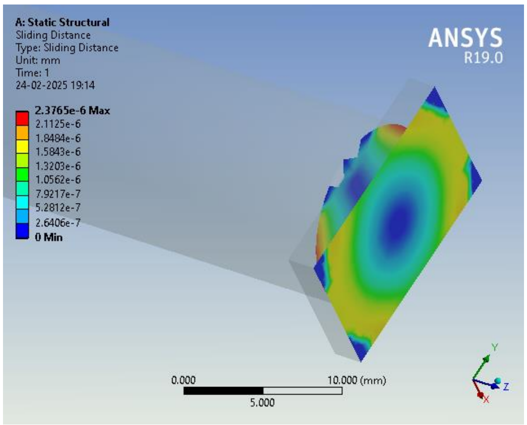

Fig 18: Sliding Distance at 500 rpm, 15 N - 50% epoxy + 35% CF+ 15%STF

3) Frictional Stress

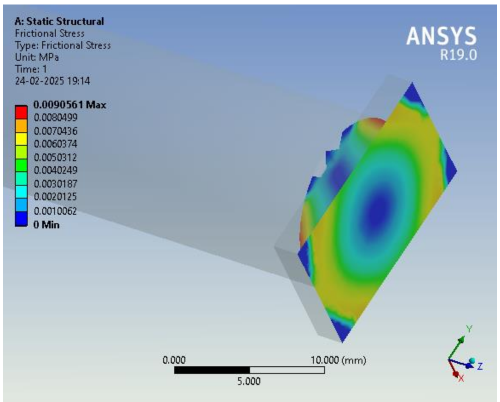

Fig 19: Frictional Stress at 500 rpm, 15 N - 50% epoxy + 35% CF+ 15%STF

The table 9 represents the wear test properties are like Pressure contact, Sliding distance and frictional stress at 500 rpm, 15 N and the 50% epoxy + 35% CF+ 15%STF.

Table 9: Pressure contact, Sliding distance and frictional stress at 500 rpm, 15 N -50% epoxy + 35% CF+ 15% STF

Si.No.	Pressure at contact (MPa)	Sliding Distance (mm)	Frictional stress(MPa)
1	0	0	0
2	0.026785	2.6406 e-7	0.0010062

3	0.053571	5.2812 e-7	0.0020125
4	0.080356	7.9217 e-7	0.0030187
5	0.10714	1.0562 e-6	0.0040249
6	0.13393	1.3203 e-6	0.0050312
7	0.16071	1.5843 e-6	0.0060374
8	0.1875	1.8484 e-6	0.0070436
9	0.21428	2.1125 e-6	0.0080499
10	0.24107	2.3765 e-6	0.0090561

The figures 20, 21, 22 represents for pressure contact at 15 N, speed 700 rpm with the composition of 50% epoxy+ 35% CF+ 15%STF.

ii) 700rpm, 15N

1) Pressure at Contact

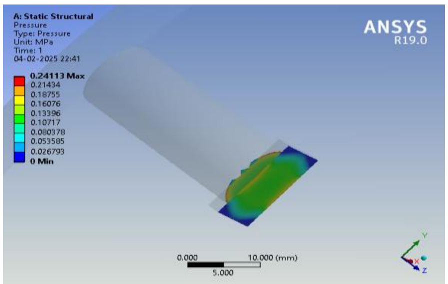

Fig 20: Pressure at Contact at 700 rpm, 15 N - 50% epoxy + 35% CF+ 15%STF

2) Sliding Distance

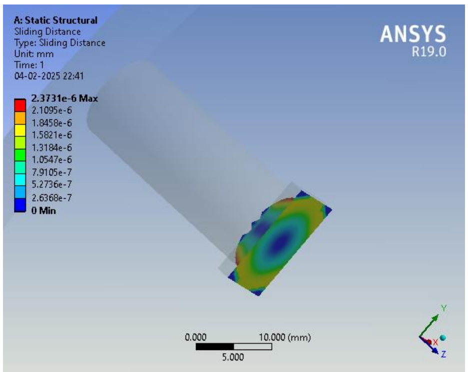

Fig 21: Sliding distance at 700 rpm, 15 N - 50% epoxy + 35% CF+ 15%STF

3) Frictional Stress

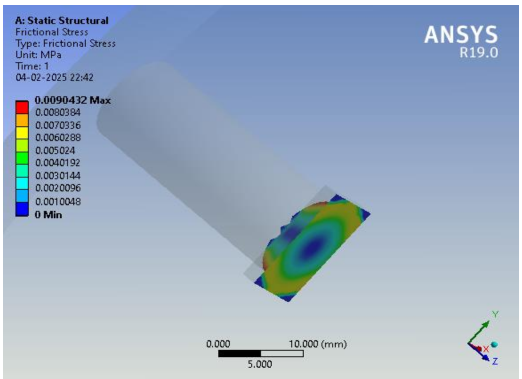

Fig 22: Frictional Stress at 700 rpm, 15 N - 50% epoxy + 35% CF+ 15%STF

The table 10 represents the wear test properties are like Pressure contact, Sliding distance and frictional stress at 700 rpm, 15 N and the 50% epoxy + 35% CF+ 15%STF.

Table 10: Pressure contact, Sliding distance and frictional stress at 700 rpm, 15 N 50% epoxy + 35% CF+ 15%STF

Si. No.	Pressure at contact (MPa)	Sliding Distance (mm)	Frictional stress (MPa)
1	0	0	0
2	0.026793	2.6368 e-7	0.0010048
3	0.053585	5.2736 e-7	0.0020096
4	0.080378	7.9105 e-7	0.0030144
5	0.10717	1.0547 e-6	0.0040192
6	0.13396	1.3184 e-6	0.005024
7	0.16076	1.5821 e-6	0.0060288
8	0.18755	1.8458 e-6	0.0070336
9	0.21434	2.1095 e-6	0.0080384
10	0.24113	2.3731 e-6	0.0090432

The table 11 represents the wear test properties are like Pressure contact, Sliding distance and frictional stress comparison between at 500 rpm, 700 rpm in 15 N and the 50% epoxy + 35% CF+ 15%STF

Table 11: Comparison between Pressure contact, Sliding distance and frictional stress at 500 rpm & 700 rpm, 15 N 50% epoxy + 35% CF+ 15%STF

Si. No	Static structural	500 rpm	700 rpm
1	Pressure at Contact (MPa)	0, 0.026785 to 0.24107	0,0.026763 to 0.24113
2	Sliding Distance (mm)	0, 2.6406 e-7 to 2.3765 e-6	0,2.6368 e-7 to 2.3731 e-6
3	Frictional Stress (MPa)	0, 0.0010062 to 0.0090561	0, 0.0010048 to 0.0090432

The table 12 represents the wear test properties are like Pressure contact initial and final results comparison between at 500 rpm and 700 rpm - 15 N in the 50% epoxy + 35% CF+ 15%STF.

Table 12: Comparison between Pressure contact at 500 rpm & 700 rpm, 15 N with 50% epoxy + 35% CF+ 15%STF

Si. No	Static Structural	Pressure at Contact (MPa)
1	500 rpm initial	0.026785 or 26.785 KPa
2	500 rpm final	0.24107 or 241.07 KPa
3	700 rpm initial	0.026763 or 26.763 KPa
4	700 rpm final	0.24113 or 241.13 KPa

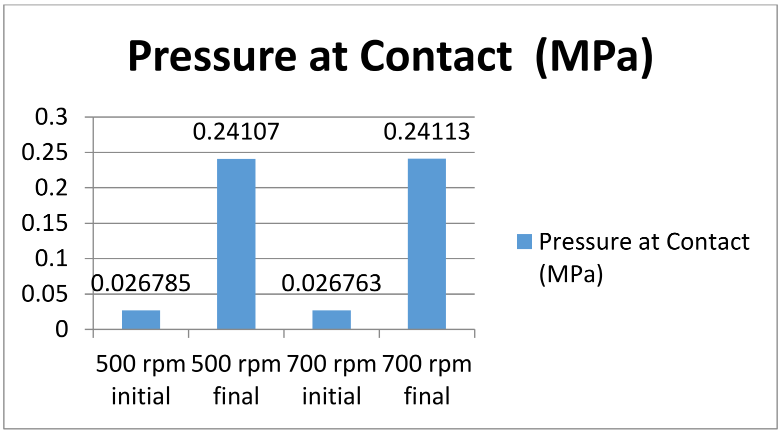

Fig 23: Comparison between Pressure contact at 500 rpm & 700 rpm, 15 N 50% epoxy + 35% CF+ 15%STF

The table 13 represents the wear test properties are like Frictional Stress at initial and final results comparison between at 500 rpm and 700 rpm - 15 N in the 50% epoxy + 35% CF+ 15%STF.

Table 13: Comparison between Frictional Stress at 500 rpm & 700 rpm, 15 N 50% epoxy + 35% CF+ 15%STF

Si. No	Static Structural	Frictional Stress (MPa)
1	500 rpm initial	0.0010062 or 1.0062 KPa
2	500 rpm final	0.0090561 or 9.0561 KPa
3	700 rpm initial	0.0010048 or 1.0048 KPa
4	700 rpm final	0.0090432 or 9.0432 KPa

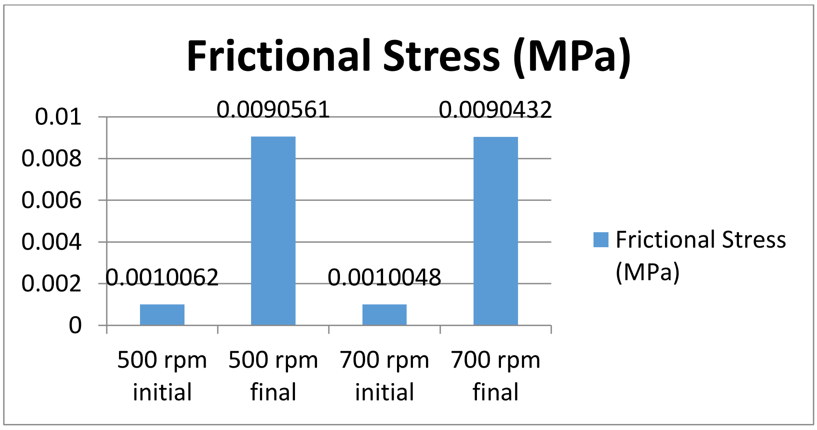

Fig 24: Comparison between Frictional Stress at 500 rpm & 700 rpm, 15 N - 50% epoxy + 35% CF+ 15%STF

The table 14 represents the wear test properties are like Sliding Distance (mm) at initial and final results comparison between at 500 rpm and 700 rpm - 15 N in the 50% epoxy + 35% CF+ 15%STF.

Table 14: Comparison between Sliding Distance at 500 rpm & 700 rpm, 15 N 50% epoxy + 35% CF+ 15%STF

Si. No	Static Structural	Sliding Distance (mm)

1	500 rpm initial	2.6406
2	500 rpm final	2.3765
3	700 rpm initial	2.6368
4	700 rpm final	2.3731

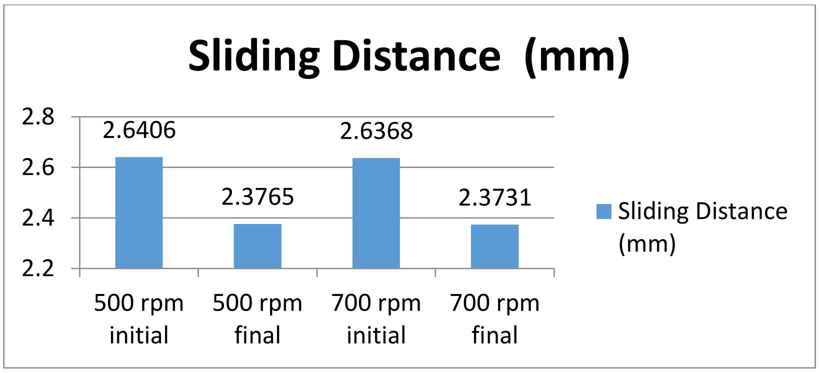

Fig 25: Comparison between Sliding Distance at 500 rpm & 700 rpm, 15 N, 50% epoxy + 35% CF+ 15%STF

SUMMARY

The summary of this chapter is:

- Wear strength of composites are found to progressively rise when the proportion of carbon fibers from 30% STF to 35% STF, after which there is a decline in strength for the percentage of ST fibers from 20% STF to 15% STF.
- The fibre percentage and fibre weight percentage are optimized as 15 percentageand 20 percentage.

4. CONCLUSIONS AND SCOPE OF FUTURE WORK

This chapter deals with the research findings of this present research work, limitation of thepresent research work and future scope.

4.1 CONCLUSIONS

- The Wear test was conducted at 500 rpm and 700 rpm speeds. In each speed we have taken the load (15 N) with 50% Epoxy+ 30% CF+ 20% STF and the frictional co efficient is 0.75 and the composition with 50% Epoxy + 35% CF + 15% STF and the frictional coefficient is 0.41.
- **1**) From the analysis, The **pressure contact** initial result value is 0.026957 MPa and final result value is 0.24258 MPa at 15 N and speed at **500rpm** with 50% Epoxy+ **30% CF+ 20%STF**
- From the analysis, The **pressure contact** initial result value is 0.026785 MPa and final result value is 0.24107 MPa at 15 N and speed at **500rpm** with 50% Epoxy+ **35% CF+ 15%STF**
- The carbon fiber % increases from 30 % to 35 % then the pressure contact **is reduced** from 0.24258 MPa to 0.24107 MPa at **500 rpm** speed.

- From the analysis, The pressure contact initial result value is 0.026963 MPa and final result value is 0.24266 MPa at 15 N and speed at **700rpm** with 50% Epoxy+ 30% CF+ 20%
- From the analysis, The pressure contact initial result value is 0.026785 MPa and final result value is 0.24107 MPa at 15 N and speed at **700rpm** with 50% Epoxy+ 35% CF+ 15% STF.
- The carbon fiber % increases from 30 % to 35 % then the pressure contact is **reduced** from 0.24266 MPa to 0.24107 MPa at **700 rpm** speed.

- **2**) From the analysis, The **sliding distance** initial result value is 2.4035 e-7 and final result value is 2.1632 e-6 at 15 N and speed at **500rpm** with 50% Epoxy+ **30% CF+ 20%STF.**
- From the analysis, The **sliding distance** initial result value is 2.6406 e-7 and final result value is 2.3765

e-6 at 15 N and speed at **500rpm** with 50% Epoxy+ **35% CF+ 15% STF**.

- The carbon fiber % increases from 30 % to 35 % then the sliding distance **is increased** from 2.1635 e-6 to 2.3765 e-6 at **500 rpm** speed.

- From the analysis, The sliding distance initial result value is 2.3982 e-7 and final result value is 2.1584 e-6 at 15 N and speed at **700rpm** with 50% Epoxy+ **30% CF+ 20%STF**
- From the analysis, The sliding distance initial result value is 2.6368 e-7 and final result value is 2.3731 e-6 at 15 N and speed at **700rpm** with **50% Epoxy+ 35% CF+ 15%STF.**
- The carbon fiber % increases from 30 % to 35 % then the sliding distance is **increased** from 2.1584 e-6 to 2.3731 e-6 at 7**00 rpm** speed.

- 3) From the analysis, The **frictional stress** initial result value is 0.0016754 MPa and final result value is 0.015079 at 15 N and speed at **500rpm** with 50% Epoxy+ 30% CF+ 20%
- From the analysis, The **frictional stress** initial result value is 0.0010062 MPa and final result value is 0.0090561 at 15 N and speed at **500rpm** with 50% Epoxy+ 35% CF+ 15% STF
- The carbon fiber % increases from 30 % to 35 % then the frictional stress **is reduced** from 0.015079 MPa to 0.0090561 MPa at **500 rpm** speed.

- From the analysis, The frictional stress initial result value is 0.0016717 MPa and final result value is 0.015045 MPa at 15 N and speed at **700rpm** with 50% Epoxy+ 30% CF+ 20%STF
- From the analysis, The frictional stress initial result value is 0.0010048 MPa and final result value is 0.0090432 MPa at 15 N and speed at **700rpm** with 50% Epoxy+ 35% CF+ 15%STF
- The carbon fiber % increases from 30 % to 35 % then the frictional stress **is reduced** from 0.015045 MPa to 0.0090432 MPa at 7**00 rpm** speed.

- On the wear side, it is found that the variable load affects the specific wear rate in relation to the sliding distance. The change in the magnitude of the specific wear rate is observed in all chemical treatments that may occur due to the improvement of the adhesion and the change in the morphology of the fibre surface.
- The higher content of Sansevieria/ CF in hybrid composites gives greater strength tothe composite structure. Among hybrid composites, the hybrid composite layer model retains the highest bending strength (hardened at 60° C). The general observation is that the inclusion of Sansevieria trifasciata fibre in the polymer matrix significantly reduces the strength of the composite and significant improvements in wear properties are observed at highercuring temperatures. Regardless of the fibre architecture, CF and STF reinforced composites show improved wear strength of pure polymer.
- It has been found that the sequence of the CF and STF layers affects the wear strength of hybrid composites at the same total weight content. In all cases, both alkaline and physiological treatment improve these properties.

4.2 SCOPE OF FUTURE WORK

- The experiment can be extended by adding other potential natural fibres, by changing fibre orientation and fibre content.
- Ansys Work Bench Tool can be used to model and analyze the experimental data for various compositions and properties, including scanning electron microscope (SEM) analysis, differential thermo gravimetric analysis (DTG), and thermo gravimetric analysis(T.G.A.).
- The tests can be expanded to include other machining operations like milling and drilling.

REFERENCES

1. Kim, S. W., S. H. Lee, J. S. Kang, and K. H. Kang. 2006. “Thermal conductivity of thermos plastics reinforced with natural fibers”. Int. J.Thermophys. 27: 1873–1881.
2. Bregar, Bill. "Value keeping the carbon fibre from mass selection - Plastics News".Plastics News. Chronicled from the first on 2016-12-09. Recovered 2017-05-25.
3. "Sansevieria trifasciata". World Checklist of Selected Plant Families Illustrious Botanic Gardens, Kew.

Recovered 2012-12-31.

4. Srinivasan, V. S., S. Somasundaram, D. Aravindan, V. Manikandan, and R. Narayanasamy. 2011. Microstructural, Physical-chemical and mechanical characterization of Sansevieria cylindrical fibres—An exploratory investigation. Materials & Design 32:453–61. doi: 10.1016/j.matdes.2010.06.004.
5. Europe, pp. 105–111. doi: 10.5604/12303666.1201139.Hossain, Md Rashnal, Md Aminul Islam, Aart Van Vuurea, and Ignaas Verpoest. "Tensile behavior of environment friendly jute epoxy laminated composite." ProcediaEngineering 56 (2013): 782
6. LassaadGhali, SlahMsahli, MondherZidi and FaouziSakli , Effects of fibre weight ratio, structure and fibre modification onto flexural properties of luffapolymer composites, Advances in Materials Physics and Chemistry, 1 (2011), 78-85.
7. Sachdeva, R. C. 2003. "Fundamentals of Engineering Heat and Mass Transfer", 2nd ed. p. 30.
8. New Delhi: New Age International Limited Publishers.
9. Ye,yueping, et al. " Evaluation at the thermal and mechanical homes of HNT – toughened epoxy/carbon fibre composites."Composites element B: engineering 42.8(2011):2145-2150.
10. Dr Sheth K N and Upadhyay Darshan M (2016)," Conference Issue - Feb 2016.
11. "Environmental Awareness on Green Buildings among Builders and Civil Contractors in the State of Gujarat"
12. Venkata Reddy G, VenkataNaidu S, ShobhaRani T and Subha MCS,Compressive, chemical resistance and thermal studies on kapok/sisal fabrics polymer composites, Journal of Reinforced Plastics and Composites, 28 (12) (2009), 1485-1493.
13. Mehmet Colakoglu , Damping and vibration analysis of polyethylene fibre composite under varied temperature, Turkish Journal ofEngineering and Environmental Sciences, 30 (2006), 351-357.
14. Sanjay, M. R., P. Mahdi, M. Jaw aid, P. Senthamaraikannan, S. Sandhill, and S. Pradeep. 2018. Characterization and Properties of natural fibre polymer composites: A comprehensive review. Journal of Cleaner Production 172:566–81.doi: 10.1016/j.jclepro.2017.10.101.
15. Samson Rewire & BlancaTom ova (2015) Morphological, Thermal, and Mechanical Characterization of Sansevieria trifasciata Fibres, Journal of Natural Fibres, 12:3, 201- 210, DOI: 10.1080/15440478.2014.914006.
16. Rajesh Ghosh, Reena G and Rama Krishna A, Effect of fibre volume fraction on the tensile strength of Banana fibre reinforced vinyl ester resin composites, International Journal of Advanced Engineering Sciences and Technologies, 4 (1) (2011), 89-91.
17. Winowlin Jappes JT and Siva I, Fractography analysis of naturally woven coconut sheath reinforced polymer composite: A novel reinforcement, Plastics Technology and Engineering, 51 (1- 6) (2012), 419-424.
18. Winowlin Jappes JT and Siva I, Fractography analysis of naturally woven.