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WEAR STUDY ON HYBRID NATURAL FIBER EPOXY COMPOSITE MATERIALS USED AS AUTOMOTIVE BODY SHELL

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ABSTRACT

This paper constitutes the study of 40% jute mat fiber, 40% epoxy resin, 20% coconut shell powder. Composite material used as bio-material characterization epoxy composite material with the low density, economical and the mechanical behavior. Epoxy resin IY556 as the matrix material and the hardness –IIY951 with the natural fibers as the ERP material. Randomly continuous long fiber orientation of Jute mat with stitched and unstitched condition. The plates are manufactured by hand layup fabrication method; the specimens are prepared (300x300x3mm). Test specimens were prepared and conducted the standard samples test. The analysis were performed by using a pin-on-disk equipment and is performed under the ASTM G-99 standard for the PIN-ON-DISK wear test conducted in this research the specimens were a pin with a rounded tip, which is positioned perpendicular to a flat circular disk. It is found that substantial improvements in tribological properties.

Keywords: hand layup fabrication technique, wear resistance natural fiber (jute mat) coconut shell powder.

1. INTRODUCTION

Due to their less mass density, superior environmental sociability, and cost reduction has been proved mainly attractive of high-tech applications. Fibers which are natural will have individual benefit in compare to synthetic fiber in those areas abundantly available. The fibers which are present naturally signify an environmentally sociable alternatively by virtue of various gorgeous attributes that includes lesser density, low cost and ease of processing, resin composite material used. Bio composites material base on biopolymers and natural fibers used as automatic body shells and bio composites plates based on biopolymers and natural fibers used as automatic body shells. Natural fibers present vital advantages such as low appropriate stiffness, density and mechanical characteristics and highly disposable and renewability. Fiber which has natural reinforced polymer composite plates which are low stiff than metals may be good alternatives because of properties closer to mechanical properties. Manufacturing of fiber which is natural are reinforced polymer composite plate material by using bio epoxy resin. Biomaterial devices used in automotive body shells. Great number of application is manufactured. The important basic requirements that car body must accomplish in order to function sufficiently are summarize in this section.

- Suitable design.
- Corrosion resistant.
- Resistance to implant wear.

2. METHODOLOGY

Wear analysis are carried out by means of epoxy resin LY556 as a matrices material and hardener –HY 951 through natural fiber 0(Jute mat) as the reinforced material (with fiber weight fraction, random unbroken long fiber orientation with stitched mat and unstitched mat) by using hand layup manufacturing methods. As per ASTM standard G-99 the specimens are prepared for wear tests.

3. OBJECTIVE

The objective of the present study is:

- To report wear analysis.
- To study wear properties of composite plates.
- To compare results of wear with different orientation (stitched and unstitched).

4. EXPERMENTAL PROCEDURE

The natural fibers such as jute mat, coconut shell was extracted by the decorating process. Continuous fiber fabrics mat used for as raw material first jute mat are cleaned in the distilled water. The cleaned are dried in the natural sunlight source after drying again cleaned by chemical washing process. The chemical composition is 85% sodium hydroxide (NaOH) is mixed with 15% distilled water. The dried mat is tipped in the diluted sodium hydroxide solution which clean from soot and dust and get smooth fiber mat. It is again dried in the natural sunlight. The dried fiber mat is cut in the length of (300x300x3mm) 12 pieces by manually cut mat fiber are stitched by sewing machine as angle of 45degree with the equal gap of 10mm for four pieces again (45x45degree) for four pieces prepare the rubber sheet mould placed over the glass sheet. The three types of reinforced epoxy composites are prepared. In this research, we make use of the following three methods as follows.

(a) un stitched (b) stitched 45degree (c) stitched 45X45

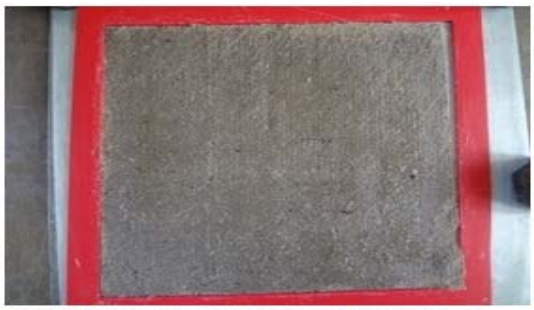
Table-1. Properties of natural fiber and coconut shell powder.

PROPERTY	JUTE MAT	COCONUT SHELL POWDER
Density (g\cm^3)	1.46	0.62 – 0.7
Tensile strength (N\mm^2)	400 – 800	320 – 800
Stiffness [kN\mm^2]	10 – 30	10 – 20
Elongation at break [%]	1.8	150
Moist absorption [%]	1.2	2.8%
Price of raw fiber [s\kg]	Rs 0.35	Waste plates

5. PLATES USEDFOR FABRICATION WORK

i. Matrix material selected epoxy resin LY 556 and HY- 951 as the finder for the resin.
ii. Natural fiber jute mat with cleaned and dried
iii. Four pieces unstitched four pieces stitched 45 and four pieces cross stitched (45x45)
iv. Preparation of specimen (300x300x3mm) 9plates
v. Preparation and fabrication of wear test specimen
vi. Wear test specimen fabricated from the main plate of 8mm diameter and the thickness of3mm according to the ASTM standard.

(a) Steel plate with mould 300x300mm



(b) Mould with jute mat 300X300mm

(c) Mould preparation with coconut shell powder

(d) Laying of Jute mat with epoxy resin

6. WEIGHT FRACTION OF THE MATRIX MATERIAL

Weight fraction is calculated by multiplying volume of mould and density of matrix. The weight of the matrix and the specified weight of fiber mat is taken with stitched and unstitched condition and added with filler material. For the hybrid mixture, the equivalent weight of

fiber obtained is shared by coconut shell powder (filler material).

7. EXPERIMENTAL TEST

Cutting the specimen by water jet machine. There are very small pins according to ASTM G - 99 in round shape 8mm diameter x 3mm thick.

(e) Wear test pin specimens

(f) Wear test disk specimen details

A - Unstitched jute mat fibre + epoxy resin+ coconut shell powder
B - Stitched jute mat (45) fibre + epoxy resin+ coconut shell powder
C - Cross stitched jute mat (45 x 45) fibre + epoxy resin+ coconut shell powder
D - Unstitched jute mat fibre + epoxy resin
E - Unstitched jute mat (45) fibre + epoxy resin
F - Cross stitched jute mat (45 x 45) fibre + epoxy resin
G - Unstitched glass fibre mat fibre + epoxy resin
H - Stitched glass fibre mat (45) fibre
I - cross stitched glass fibre mat (45 x 45) fibre + epoxy resin
J - Unstitched glass fibre mat fibre + epoxy resin + coconut shell powder
K - Stitched glass fibre mat (45) fibre + epoxy resin + coconut shell powder
L - Cross stitched glass fibre mat (45 x 45) fibre + epoxy resin + coconut shell powder

a) Wear test by pin-on-disc machine

(g) Specimen weight analysis

(h) Wear test analysis

This test is conducted in laboratory for determining the wear of plates. This is done by sliding pin-on-disc apparatus. The pin is placed perpendicular to the flat circular disc. A ball is held, is often used as a pin. The machine for test causes the disc specimen or the pin to rotate about disc center. The sliding path of a circle on the surface of sample pin which is pressed against the disc as specified load generally by means of an lever or arm and weight which is attached.

b) Data acquisition

The friction coefficient is displaced in a real-time personal computer. The data collected can be viewed for entire specified test. The data can be stored and retrieved later for detailed analysis. The software allows four different kind of test files for online analysis. The software display time for test, turn count linear velocity, and user defined test parameter of this data can be stored and printing can be done along with friction traces.

Table-2. Weight analysis.

SL. NUMBER	SAMPLE	BEFORE WEAR SPECIMEN WEIGHT(gm)	AFTER WEIGHT SPECIMEN WEIGHT	DIFFERENCE
1	A	11.836	11.835	0.001
2	B	11.740	11.739	0.001
3	C	11.440	11.438	0.002
4	D	11.130	11.129	0.001
5	E	11.110	11.108	0.002
6	F	11.108	11.107	0.001
7	G	11.564	11.564	0
8	H	11.746	11.745	0.001
9	I	11.115	11.114	0.001
10	J	11.511	11.510	0.001
11	K	11.450	11.450	0
12	L	11.200	11.119	0.001

Purpose: regards of friction force and wear rate in sliding contacts in dry controlled environment.

Application: Fundamental wear studies pv diagrams wear mapping friction and wear testing of metals and ceramics polymers and composites.

Standards: ASTM G – 99 instrumented and data acquisition system is for the measurement of revolution per minute, frictional force, wear and temperature. The pc acquires data in online and displaced. For the individual test the graphs can be printed. The result of different test can be super in forced by comparative viewing.

8. RESULT AND DISCUSSION

Wear test results for unstitched jute mat fiber composite plate.

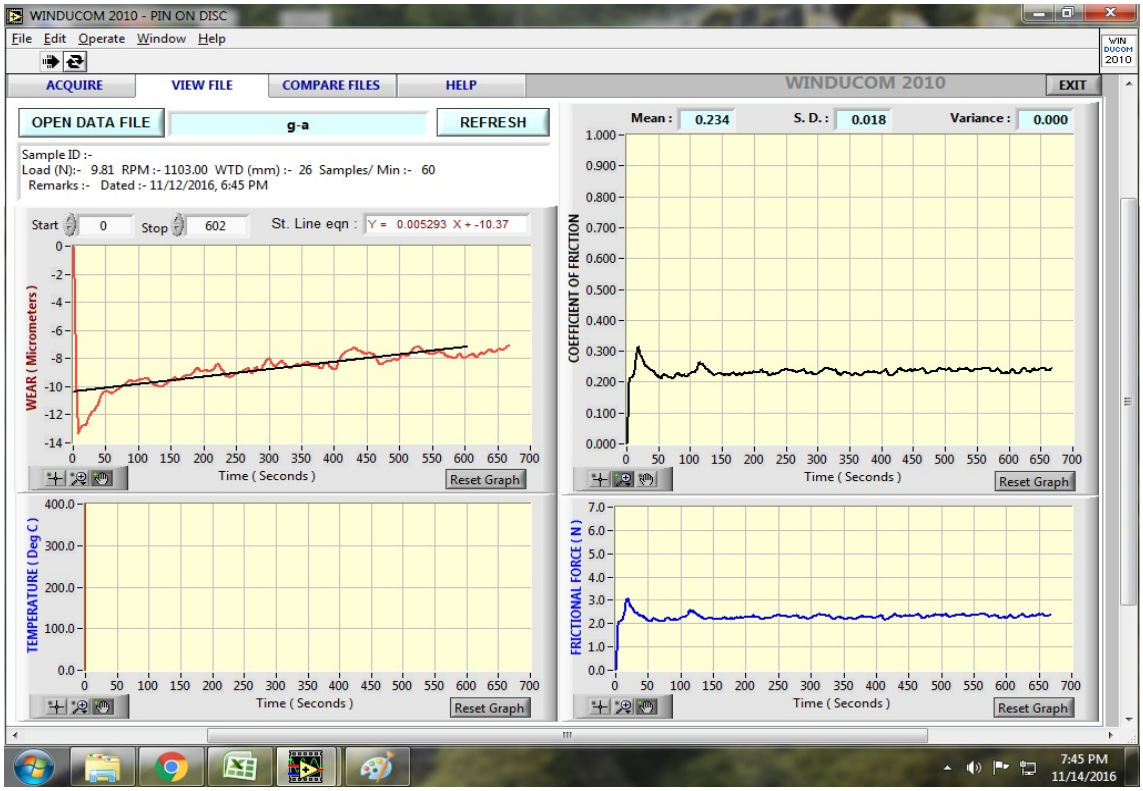


Figure-1. Wear coefficient of friction and frictional force for unstitched with coconut shell powder.

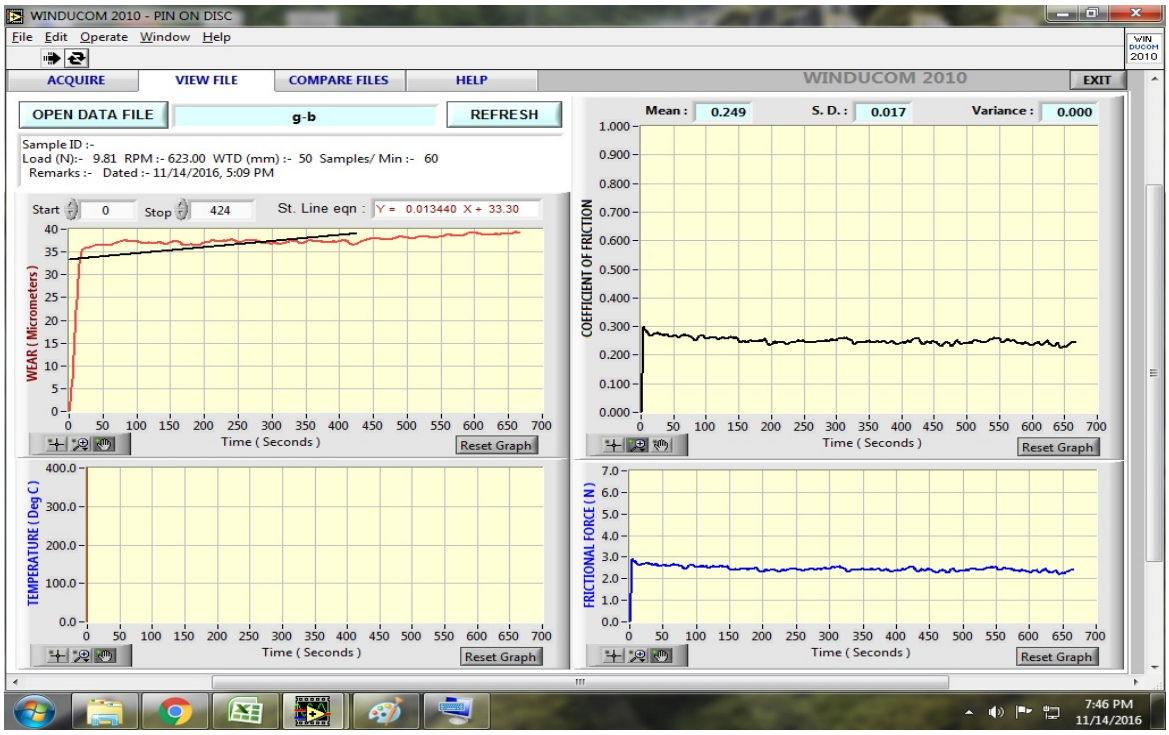


Figure-2. Wear coefficient of friction and frictional force for stitched 45 with coconut shell powder.

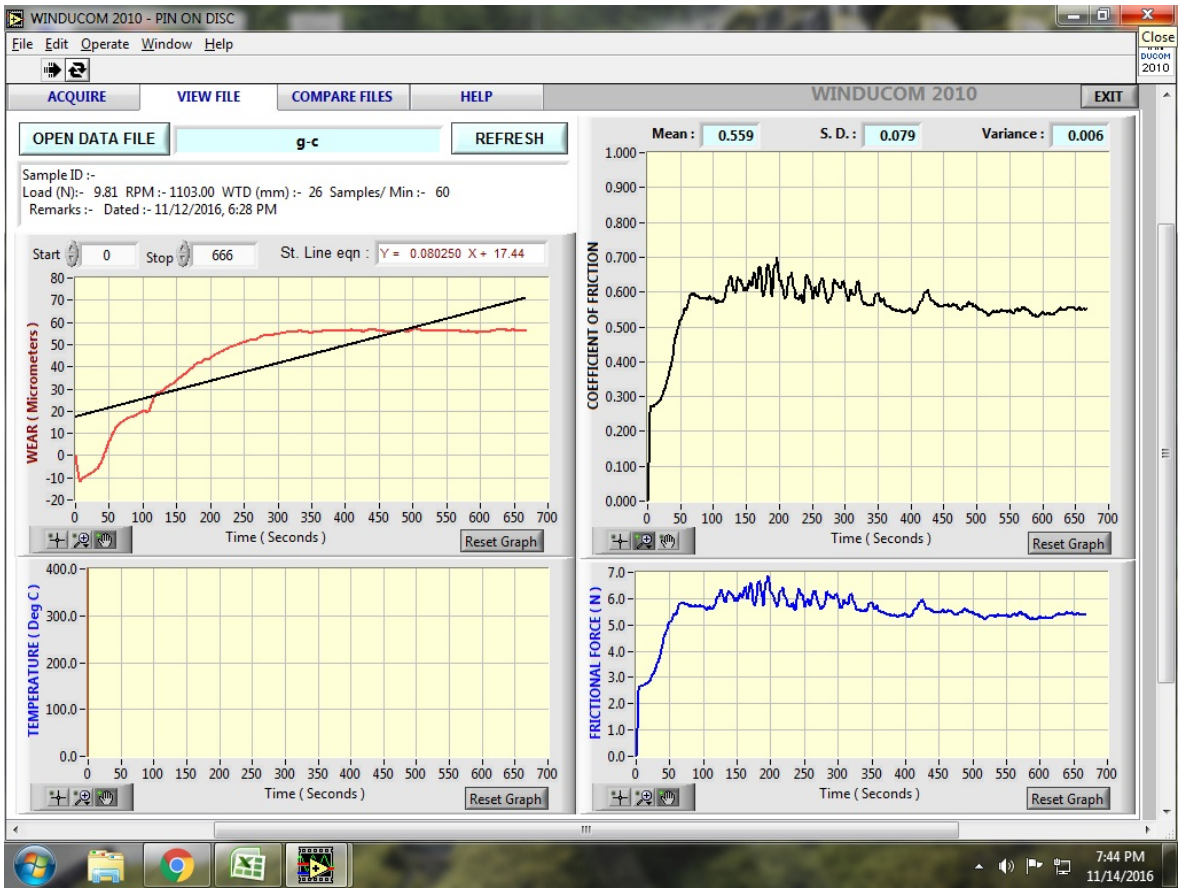


Figure-3. Wear coefficient of friction and frictional force for stitched 45x45 with coconut shell powder.

9. CONCLUSIONS

According to experimental results unstitched jute fiber polymers composite plates has wear rate of -8 micrometers for the results at constant load of 9.81N, it is found that as increases in time the wear rate also increases. Stitched (45^o) jute fiber polymers composite plates have wear rate of 39 micrometers, it is found that as time increases the wear rate also increases

The cross stitched (45^{o}X45^o) jute fiber polymers composite plates have wear rate of 60 micrometers, it is found that as time increases the wear rate also increases based on the analysis.

Finally, with the entire above conclusion we conclude that by increasing the percentage of the natural fiber material by adding filler material. By increasing the fiber rate the weight of the specimen decreases hence unstitched polymer composite material low weight as compare to stitching fibers.

REFERENCES

[1] Santulli C., impact properties of glass plant fiber hybrid laminates, J Mater Sci, 42, 3699 3707. 2007).

[2] Albuquerque A.C. Joseph K caralho L.H and de Almeida J. R.M effects of wettability and ageing conditions on the physical and mechanical properties of uniaxaially oriented jute roving reinforced polyester composites, comp Sci tech.60, 833-844 (2000).

[3] A.K. BLedzk and J. gassan. Composites reinforced with cellulose-based fibers, Prog.polym. Sci.24.211-274 (1999).

[4] A.N. Netravali and S. Chabba, paper entitled composites get greener, materials today 6, 22-29 (2003).

[5] G. Marsh, paper entiled a guide for green composites, reinforced plastics 48, 18-26 (2004).

[6] D. Chandra Mohan paper entitled bio composite materials based on bio polymers and natural fibers contribution as bone implants. (IJAMSAR) International Journal of Advanced Medical Science and applied research volume number I, issue number, 009-012

[7] Thillai Siva Kumar. N And Venkataraman. R paper entitled Pharmacia scenica1 (1): 1-6 (2010)

[8] K. Fujihara design of carbon \ epoxy braided composite bone plate National University of Singapore.

[9] Ramakrishna S, Mayer j, winter mantel E. leong KW. Biomedical applications of polymer-composite material: a review. Comp Sci tech 2001:61:1189-224.

[10] Yildiz, composite hip prosthesis design, PH.D thesis, Stanford University, 1993.

[11] Baixauli, *et al.,* carbon fiber composite bone plates for fixation of forearm fractures, J. bone & Joint surg. [Br], 77- B (2), 227, 1995.