Investigation Of Dry Sliding Wear Behaviour Of Glass And Jute -Isophthalic Filled With Graphite Particles

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Abstract- *These paper efforts on the manufacture of isophthalic hybrid composites they have been used in a variety of application like aerospace, automotive, sports, ships and constructional work. Many other design applications because of its flexible properties. This project aims to increase the Wear resistance of isophthalic resin and the reinforcement introduced are Graphite and Jute, glass fibre. The Composites are fabricated with the different weight percentage using hand layup techniques and are machines to adapt into pins of 12mm . Wear analysis were performed on the Pin-on-disc apparatus, optimization was conceded with the process parameters load, speed, time and thus obtaining the optimum results. The design of experiments is designed by the Minitab software. Microstructure examination of the fabricated composite was done using the inverted microscope and it presented that there was a proper distribution of reinforcement particles.*

Keywords- Isophthalic resin composite, Glass, Jute, graphite, Wear analysis.

I. INTRODUCTION

The FRB matrix composites are selected because of its light weight and high performance and it is mostly focused in the usage of automotive parts because of its high strength to weight ratio. The literature on Isophthalic matrix composites exposes that the adding of convinced percentage of reinforcement results in the increase in the property of isophthalic. The investigation of wear behavior of isophthalic composite by including the graphite particles as the reinforcement, where its optimum conditions were found out for wear volume loss and coefficient of friction [Arun,et al.(1)].The analyse the wear behaviour of rice husk filled epoxy composites and concluded that rice husk has good filler characteristics and increased the sliding wear resistance of the polymer resin. [Khedkar, et al(2)]. studied the tribological behavior of polytetrafluroethylene (PTFE) composites with filler materials such as carbon, graphite, E glass fibers, MoS2 and poly-p-phenyleneterephthalamide (PPDT) fibers. The authors observed an increase in hardness and wear resistance while the coefficient of friction is slightly affected and remained low. [Basavarajappa, et al(3)]. investigated the tribological behaviour of G-E composites with SiC and graphite particles as secondary fillers. A plan of experiments based on Taguchi's design of experiments was adopted to acquire data in a controlled manner. [Suresha et al.(4)]. investigated the influence of inorganic fillers like silicon carbide (SiC) and graphite on the wear of the glass fabric reinforced epoxy (G-E) composites under dry sliding conditions. Higher wear volume loss has been recorded with increase in sliding velocity and the coefficients of friction showed an increasing trend with increase in load and sliding velocity. [Thomas Larsen et al.(5)] studied the friction and wear properties of glass /epoxy and carbon aramid /epoxy composite and found that, coefficient of friction decreased by replacing carbon aramid with glass fiber, and wear rate of glass /epoxy composite is more than the carbon aramid /epoxy composites. [Suresha,et al(6)]. investigated the friction and wear behavior of glass-epoxy composite with and without graphite filler. They concluded that the graphite filled glass epoxy composite showed higher resistance to sliding wear as compared to plain glass-epoxy composites. [Feng Hua Su, et al(7)]. studied the influence of nano Al2O3 and Si3N4 particulate filler in carbon fabric / phenolic resin composites on tribological properties, and concluded that, filled composites improved the friction and wear behavior of carbon fabric composites. Particulates increase the interfacial bonding strength, which increases mechanical strength. Nano particulates improve wear resistance of carbon fabric composites at elevated temperature. Wear rate of filled carbon fiber composite is less than the unfilled. [T.Madhusudhan , et al(8)].investigated the two-body abrasive wear test with different loads and abrading distances by using a pin on a disk set up. Studied the surface hardness strength of SiC filled hybrid composites and result showed that the wear volume increased with increasing abrading distance and the specific wear rate decreased with increasing abrading distance and load for SiC particle filled Hybrid composites. [Kishore, et al (9)]. studied the slide wear characteristics of a glass–epoxy (G–E) composite, filled with either rubber or oxide particles using a block –on – roller test configuration. [M.H. Shaikh , et al(10)]. studied the Tribological behavior of epoxy composites filled with WS2 particulates were studied using a pin-on-disc wear apparatus under dry sliding conditions and result shows that filler content is the most predominant factor as far as specific wear rate concerned hence filler improves the wear property.

The present work focuses on the investigation of tribological characteristics such as wear behavior of Isophthalic resin reinforced with the varying percentage of Glass, Jute and Graphite, where taguchi method is used to determine the optimum conditions on the test conducted.

II. MATERIAL SELECTION

ISOPHTHALIC RESIN: The reaction of an organic acid with an alcohol results in the creation of the ester. By consuming a di-functional acid and a di-functional alcohol linear polyester is manufactured. Properties of the polyester canister be various by using different mixtures of different di-acids and glycols. One such mixture produces isopthalic resin. They are shaped from isophthalic acids and are considered by better strength, heat resistance, toughness and flexibility. The acid sets are separated by one carbon of benzene ring. This increases the chance to produce polymers with great linearity and high molecular weight. They are mostly used in automotive parts, bowling walls, gasoline, swimming pools, aerospace products and civil construction products.

JUTE FIBER: In the latest times usage of natural fiber has initiate immense value in making eco-friendly polymer composites. Naturalfiber-reinforced polymer composites have involved more and more research interests owing to their potential as an alternative for synthetic fiber composites. Due to increase in people, natural resources are being subjugated significantly as an alternative to synthetic materials. Natural fiber composites have the advantages such as easy availability, renewability of raw materials, low cost, light weight, high specific strength and stiffness. Mechanical properties of the composite are highly influenced by the hydrophilic nature of natural fibers that would result in porous materials. This can be precise by reducing water absorption satisfied in the natural fiber. Both natural fibers that are used in the experimental work were procured from the local source.

E GLASS FIBER: Some commonly used synthetic fibers for composites are glass, carbon and aramid etc. Among them, glass fibers are the most commonly used fibers for engineering composites. Hence, glass fiber is chosen as the reinforcing material in this work. Glass fiber is commercially available in abundance with good mechanical properties.

GRAPHITE: Graphite is well known as a solid lubricant and its presence in isophthalic matrices makes the material, self-lubricating. Graphite being a solid lubricant can improve the machinability of the composites. Furthermore, graphite possesses excellent thermal and electrical conductivity thereby, can improve the conducting capability of composites.

Laminates of jute, E glass and isophthalic resin were prepares by hand layup techniques in a mold at room temperature. PVA release cause was applied on the surfaces of the mold to ease easy removal of the laminate when curing. For planning of filled composite laminates, filler was motley to the known amount of isophthalic resin mechanically stirred to ensure uniform distribution of filler in the resin. Hardener in the abovementioned ratio is added to the resin with fillers and additional stirred. The resin system saturated jute and glass fabric layers (120 X 50) mm were placed down on the surface of the mold one over the other until the chosen thickness is reached. A roller was used to attain uniform distribution of resin system during the layer surface. Each laminate was cured under a pressure of 30 bar using hydraulic press for 24 h. The laminates was then removed from the mold and further cured at room temperature for at least 48 h earlier use. All laminates were complete with 4 layers. All the composites were processed at a total fiber weight 48% The pattern of casting is shown in figure 1.

FIGURE 1: Mold pattern

The casted specimens of about 120ssmm are machined into smaller length of 12mm and 1mm width in which they are subjected to the wear test and Micro hardness test. The different weight proportions of the samples fabricated are tabulated in the table 1.

TABLE 1: Proportions of 3 Samples.

Sn	Matrix(Isophthalic) %volume	Reinforcement (Glass fibre) % volume	Reinforcement (Jute fibre) % volume	Filler (Granite) % volume
1	50	24	24	2
2	48	25	25	2
3	46	26	26	2

II. DRY SLIDING WEAR TEST

The fabricated specimens are machined into square components of around 12mm width and 50mm height in dimensions. The dry sliding wear is accepted out on that specimen using DUCOM Pin-On-Disc, the pins are held against the circling steel disc. The track diameter 50mm is kept constant for all the experiments. The resultant wear of the specimen is watched on the Linear Variable Differential Transducer (LVDT), the weight of the sample is measured using the weighing machine of least count 0.1 mg. The variance in the weight loss is calculated and the wear loss is calculated. The readings of the wear rate and coefficient of friction was recorded by the WINDUCOM software. The wear rate so found is tabulated in the table 5 and its corresponding graph is shown in figure 4 and 5.the paper. Do not number text heads-the template will do that for you.

FIGURE 2: Samples for Pin-On-Disc

FIGURE 3: Preheater-electric furnace

Table 2: Results of wear analysis

S.N	SAMPLE	LOAD (N)	SPEED (Rpm)	SLIDING DISTANCE (m)	TIME (mins)	VELOCITY (m/mins)	WEAR RATE (micrometre)
1	A	20	500	1800	2	3	22
2	B	20	500	1800	2	3	37
3	C	20	500	1800	2	3	80
4	A	30	500	1800	3	4.5	42
5	B	30	500	1800	3	4.5	34
6	C	30	500	1800	3	4.5	49
7	A	40	500	1800	5	6	94
8	B	40	500	1800	5	6	155
9	C	40	500	1800	5	6	178

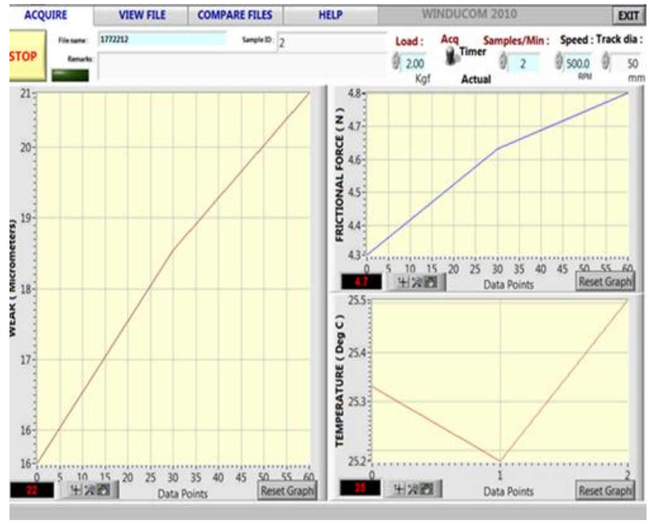

FIGURE 4: Wear graph- sample A at load 20kg

From the overhead results and from the graph, it is clear that the sample 1 of several loads 20, 30, 40 kg displays lesser wear rate when compared to both 2, 3 samples. Thus it is clear that the hybrid composite fibre with the improved percentage of reinforcement shows the greater wear resistance.

III. WEAR MORPHOLOGY

The wear morphology is completed by using the inverted microscope equipment, the morphology displays that the proper scattering of the reinforcement particles. The wear morphology of the sample is shown below in the figure 5,6 and 7.

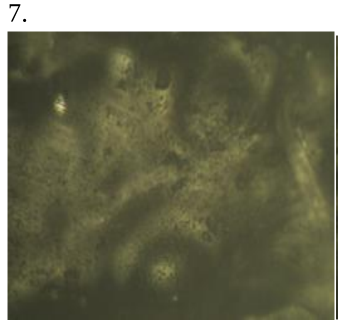

FIG 5: Wear morphology

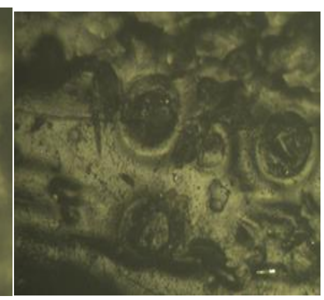

FIG 6: Wear morphology

IV. CONCLUSION

In this paper the Isophthalic resin with the different proportions is fabricated using the hand layup technique and the conclusions are prepared from the behind experimental results.

- It is concluded that the specimen with the composition Isophthalic resin (46%)-glass then jute (24%) and graphite (2%) parades the higher wear resistance with the lower wear rate as observed in the Pin-On-Disk apparatus. • The morphology also discloses the proper distribution of the reinforced additional to the samples.

Therefore it is clear that the samples fabricated with the Isophthalic resin (46%)-glass then jute (24%) and graphite (2%) using the hand layup technique .and the wear resistance on comparison with the other 2 samples.

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