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Experimental Study on Kevlar and Jute fibre Reinforced with Epoxy Resin

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Abstract- Composite materials play a major role in this new era, since every human comfort must meet some standards so to attain such standards composite material occupies a major position among the different materials for construction of different things. These materials come under the PMC which means polymer composite materials. This chapter mainly focus on the manufacturing of the polymer composites reinforced by natural fibres with epoxy resin and mixed with Kevlar fibre because of its unique features gives high strength with the mixture of required amount will give more advantage then compared with the old type metals or materials. The advantages of the natural polymer fibres are that they are renewable resources and these agricultural wastes can be utilized organize fibre composites which have more advantages then compared with conventional glass fibres and inorganic material

Index Terms – Jute fibres, Epoxy resin, Polymer matrix composites, Kevlar fibre, Synthetic fibres, Natural fibres.

1. INTRODUCTION

This paper topic is entirely based on the composite materials. The word composite materials mean mixing of two or more different or same materials to form a new material with new mechanical properties so in order to overcome the problems which are occurred by the normal metals such as iron, aluminium etc. And composite materials are of two types they are Metal matrix composite materials and second one is polymer materials matrix. And this paper is all about the polymer material matrix composites PMC.

The polymer matrix composite materials can be fabricated either with the usage of the of synthetic materials or by using the natural materials. And the special case of fabrication is done by mixing both the natural and synthetic fibres and materials. In this project the materials which are used are jute fibre, Kevlar, and epoxy resin. We knew that Kevlar is one of the strongest materials which are even utilized in the parachutes holding threads, in this only nearly 4 mm diameter threads were utilized in order to hold the person weight in the mid-air by this explanation we can estimate or come to one rough imagination of its strength and hardness and etc mechanical properties. And jute fibre being the moderate strength materials which are available at low cost is utilized in this project. And these both materials are bonded with the help of epoxy resin by hand layup technique. And later these materials are been tested under universal testing machine for conducting tensile, compression, flexural tests.

2. METHODOLOGY

The composite specimen is fabricated according to the ASTM standards. Here we had taken three cases with different Compositions according to slandered, that is the composition for case 1 is

Jute 5% +15% Kevlar +80%epoxyresin

Case 2:

5% Jute +10% Kevlar +85%epoxyresin

Case 3:

5% Jute +5% Kevlar +90%epoxyresin

And the procedure is preceded by following Hand layup method.

Table 1 -.Jute + Kevlar + epoxy resin composition

S/N	Reinforcement	Matrix	Method of fabrication
1	Jute (5%) +Kevlar (15%)	Epoxy resin (80%)	Hand layup process
2	Jute (5%) + Kevlar (10%)	Epoxy resin (85%)	
3	Jute (5%) + Kevlar (5%)	Epoxy resin (90%)	

2.1 Hand layup technique

This is the process which was followed from method and we can say it's an old method followed

- Initially take a mould of required dimensions according to ASTM standards that is
- Specimen 1: - 140 * 25*3 mm^2
- Specimen 2: -250 * 25 * 3 mm^2
- Specimen 3: - 125 * 12.7 * 3 mm^2

- And apply wax on the surface of the mould so that the fabricated specimen does not stick the base of the mould.
- Later take the epoxy resin with hardener according to the requirements with 10:1 ratio.
- Later cut the jute fiber with required sizes and weigh the fibers according the calculated values.
- place the cut pieces in the mould and apply the resin on the jute strip and keep another layer and apply the resin on that layer and repeat the process up to the last layer and finally press the layer with some roller so that the resin is distributed equally.
- Finally place some weight on the mould in order to make sure the shape of the materials is in proper shape.
- And do the grinding process in order to smooth the rough edges.

3. EXPERIMENTATION

3.1 Tensile test

The tensile testing is one of the tests which was performed in order to determine the ultimate tensile strength of the fabricated material by using the universal tensile the range of the universal testing machine is (0-300KN).

The procedure which was followed while doing the experiment is as follows.

- Initially check the machine weather the machine is in proper condition or not.
- And later arrange or fit the proper the chuck to the machine.
- And later fit the specimen in between the two chucks and tighten it properly with the help of wrench of required size.
- And start the machine either mechanically or with the help computer.
- Now lift the chuck by keeping the other chuck fixed.
- Now let the movable chuck move up wards until the specimen breaks.

Fig.1 – Tensile test specimen

3.2 Flexural test

One of the tests conducted on the universal testing machine is flexural test in this the specimen is tested by holding the specimen in between the two simply supported supports with a distance of 70 mm with each other and the tool is allowed to press at the central line of the specimen which is held rigidly on the two supports which results in the bending of the fabricated material.

After the completion of the bending of the specimen note down the readings and plot the lode versed displacement graph with the help of the final reading of the flexural test.

Fig.2 – Tensile test specimen

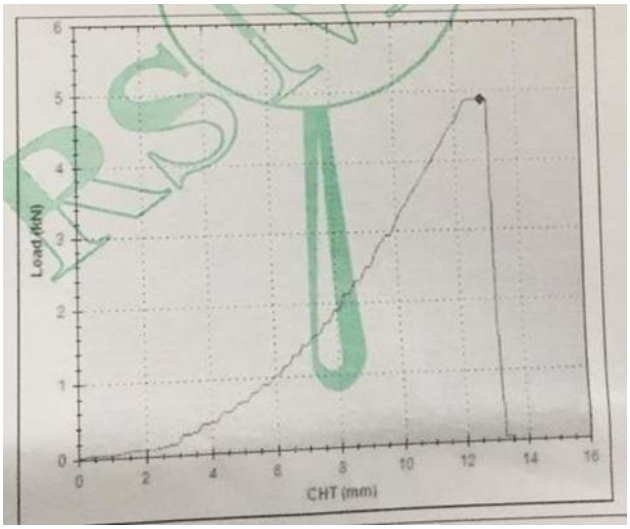
4. RESULTS AND DISCUSSION

4.1 Tensile test results

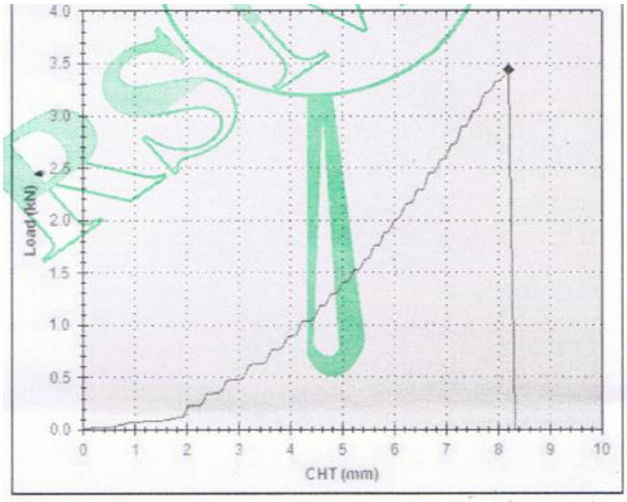
Table 2 - Final results of all three specimens

Case number	Polymer matrix composite	Tensile load (KN)	Elongation at the peak In (mm)	Tensile strength (MPA)
$Case_1$	5%J + 80%E + 15%k	4.868	12.850	60.112
$Case_2$	5%J + 85%E + 10%k	3.434	8.200	42.600
$Case_3$	5%J + 90%E +5%k	2.921	8.310	42.021

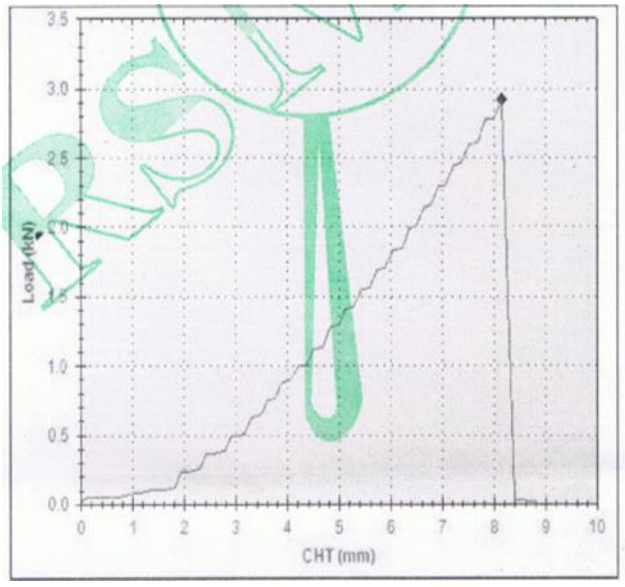
Graphh.1 - Case 1, load v/s displacement



Graph 2 - Case 2, load v/s displacement



Graph 3 - Case 3, load v/s displacement



4.2 Flexural test results

Table - 3 Final results of all three specimen

SAMPLE ID.	FLEXURAL STRENGTH (N/mm^2)
JUTE:0.29 gms, KEVLAR:0.88 gms, EPOXY:4.72 gms	3.48
JUTE:0.293 gms, KEVLAR:0.586 gms, EPOXY:4.981 gms	5.87
JUTE:0.29 gms, KEVLAR:0.29 gms, EPOXY:5.22 gms	3.28

5. CONCLUSION

From the above results I was observed that case 2 produces high values or mechanical properties then compared with other cases in the compression tests and in the tensile test specimen or case 1 have high tensile strength.

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