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Compression Testing Of Mechanical Properties In Natural Fiber Hybrid Composite Materials

K.ATHIPATHI., HEGDE SOWMITHA VIJAY, R.ARUL MARI., V.SAMUVEL LIVVIN RAJA

P.G. Student, Department Of Aeronautical Engineering,, PSN College Of Engineering And Technology, Tirunelveli,Tamilnadu, India
P.G. Student, Department Of Aeronautical Engineering,, PSN College Of Engineering And Technology, Tirunelveli,Tamilnadu, India
P.G. Student, Department Of Master Of Computer Application, PSN College Of Engineering And Technology, Tirunelveli,Tamilnadu, India
P.G. Student, Department Of Master Of Computer Application, PSN College Of Engineering And Technology, Tirunelveli,Tamilnadu, India

ABSTRACT: The mechanical properties of coir and roysteniaregia-epoxy laminate is evaluated in this project work various fiber content(25%,20%,55%) and fiber orientation (Oº,45º,90º). Composite are one of the most widely used material because of their adaptability to different situation and different climate condition the relative case of combination with other material to serve specific purposes and exhibit desirable. The natural fiber composites are mostly used in engineering applications because of their specific characteristics including light weight low density, easy availability and non abrasive natures.

KEYWORDS: Coir, Roysteniaregia, Epoxy laminate, Polymer.

I. INTRODUCTION

The availability of natural fibers is abundance and also they are very inexpensive when compared to other advanced man-made fibers. These natural fibers are used as a suitable reinforcing material environmental concern and they are now emerging as a potential alternative for glass fibers in engineering composites [1]. The natural fibers are used as reinforcements for composite materials due to its various advantages compared to conventional man-made fibers [2, 3]. The primary advantages of natural fibers are low density, low cost, biodegradability, acceptable specific properties, less wear during processing and low energy consumption during extracting as well as manufacturing composites and wide varieties of natural fibers are locally available. Natural fibers have a few disadvantages whenused as reinforcements, such as lower impact strength, higher moisture absorption which leads to dimensional changes thus leading to micro-cracking. All polymer composites absorb moisture in humid atmosphere and also when immersed in water. The effect of this moisture absorbed leads to the degradation of fiber-matrix interface region creating poor stress transfer between fiber and matrix and resulting in reduction of mechanical properties along with dimensional changes. One of the main concerns for the use of natural fiber reinforced composite materials is their susceptibility to moisture absorption and the effect on physical and mechanical properties. It is important therefore that this problem is discussed in order that these natural fibers may be considered as a favorable reinforcement in composite materials. the removal of this surface layer of lignin usually results in a better and more stable bond. Keeping in view the above facts in our present investigation, we have chosen chemical cleaning and alkali treatment as surface treatments for natural fiber fibers in order to obtain better adhesion of these fibers with the polyester resin. The mechanical properties like tensile, wear and impact strength of natural fiber-polyester are determined and optimal values are calibrated.

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II.FEATURES OF COMPOSITES

The following features attract the manufacturing industries towards the invention of natural fiber reinforced composite materials.

- High strength-to-weight ratio
- High modulus-to-weight ratio
- Low specific gravity
- Good fatigue strength
- Good corrosion resistance, although are soluble in various chemicals
- Low thermal expansion, leading to good dimensional stability
- Significant anisotropy in properties
-

III.CLASSIFICATION OF COMPOSITE MATERIALS

Composite materials can be classified into three groups on the basis of matrix material. They are:

A. Metal Matrix Composites (MMC)
B. Ceramic Matrix Composites (CMC)
C. Polymer Matrix Composites (PMC)
D. Carbon and graphic matrix composites (CMGC)

A. METAL MATRIX COMPOSITES

Metal matrix composites have many advantages over monolithic metals like higher specific modulus, higher specific strength, better properties at elevated temperatures, and lower coefficient of thermal expansion. Because of these attributes metal matrix composites are under consideration for wide range of applications viz. Combustion chamber nozzle (in rocket, space shuttle), housings, tubing, cables, heat exchangers, structural members etc.

B. CERAMIC MATRIX COMPOSITES

One of the main objectives in producing ceramic matrix composites is to increase the toughness. Naturally it is hoped and indeed often found that there is a concomitant improvement in strength and stiffness of ceramic matrix composites.

C. POLYMER MATRIX COMPOSITES

Most commonly used matrix materials are polymeric. The reason for this are two fold. In general the mechanical properties of polymers are inadequate for many structural purposes. In particular their strength and stiffness are low compared to metals and ceramics. These difficulties are overcome by reinforcing other materials with polymers Secondly the processing of polymer matrix composites need not involve high pressure and doesn't require high temperature

D .CARBON AND GRAPHIC COMPOSITES

Carbon and graphite have a special place in composite material options, both being highly superior, high temperature materials with strengths and rigidity that are not affected by temperature upto2300oC

IV LITERATURE SURVEY

Review of the related literature, allows the researcher to acquaint himself with current knowledge in the field in which he is going to conduct his research, serves the following specific purposes. The review of related literature, enables the researcher to define limit in respective field. It helps the researcher to delimit and define his problem

A. SISAL/COCONUT COIR NATURAL FIBERS – EPOXY COMPOSITES: WATER ABSORPTION AND MECHANICAL PROPERTIES

The availability of natural fibers is abundance and also they are very inexpensive when compared to other advanced man-made fibers. These natural fibers are used as a suitable reinforcing material environmental concern and they are now emerging as a potential alternative for glass fibers in engineering composites [1]. The natural fibers are used as reinforcements for composite materials due to its various advantages compared to conventional man-made fibers [2, 3].

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V DESIGN OF EXPERIMENTS

The coir-roysteniaregia composites were prepared as per 3 Level full factorial designs of fiber parameters namely; fiber content, fibre orientation. The composites were fabricated for the thickness of 3 mm and the mechanical property(compressive strength) was tested as per ASTM D256, ASTM D 5963 standard. 3k factorial design is the most widely used factorial design having three levels for each of „k‟ factors. The three levels of factors are referred to as low (-1), intermediate (0) and high (+1). If there are three factors under study and each factor is at three levels arranged in a factorial experiment, then this constitutes a 3330 Factorial design. This study was designed as below

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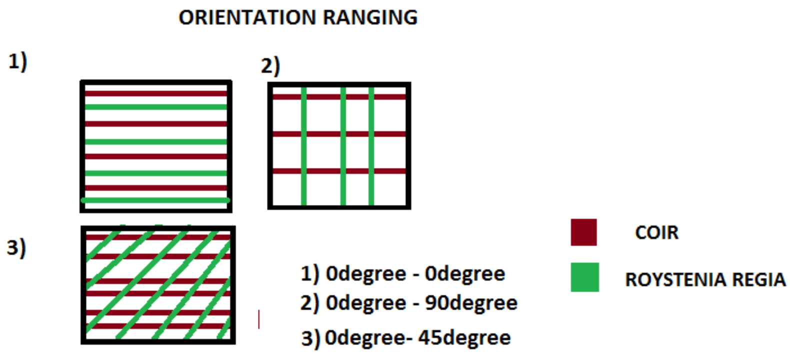

Figure.1 Orientation Ranging

A.COMPRESSION TEST

Compressive load was applied on the composite using UTM Machine and the following parameters were determined. The mechanical properties such as ultimate breaking load, displacement at maximum force and ultimate stress were determined and tabulated in Table 4.Under compression test of fibres tested, the ultimatetensile strength of banana is higher as compared with allother combinations and shown in Figure 1

Figure 1:compression testing machine

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B. COMPRESSION TEST SPECIMEN

The compression specimen is prepared as per the ASTM D638 standard. A compression test involves mounting the specimen in a machine and subjecting it to the compression. The compression process involves placing the test specimen in the testing machine and applying compress to it until it fractures. The compress force is recorded as a function of displacement. During the application of compression, the elongation of the gauge section is recorded against the applied force

Figure.2.compressive Test Specimen

VI. EXPERIMENTAL RESULT OF COIR-ROYSTENIAREGIA EPOXY MECHANICAL PROPERTIES

The results of coir-roysteniaregia epoxy mechanical properties are shown in Table 1.

Serial NO	Fiber weight	Fiber orientation(degree)	Fiber orientation (%)	Compression strength(KN)
1	15	90	45	28.190kN
2	15	0	90	23.110
3	15	0	45	18.92

Table:1.The results of coir-roysteniaregia epoxy mechanical properties

VII CONCLUSION

The mechanical properties of untreated coir-roysteniaregiafiber reinforced epoxy composites were evaluated as per ASTM standard in this investigation.
The following observations were made in evaluation of mechanical properties of untreated coir fiber reinforced epoxy composites.

- The untreated coir-roysteniaregia fiber-reinforced epoxy composites exhibited the maximum value of compressive strength of 28.190 KN for the conditions of Fiber loading of 45% and fiber orientation of 90 degree,45degree)

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