

MECHANICAL PROPERTIES FOR FABRIC-WOVEN AND KNITTED SUPPORTED BY COMPOSITE MATERIAL

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Abstract - The use of composite materials increases in many fields, for example agricultural uses, where these materials are characterized by good mechanical properties, tenacity and light weight. In this paper, we will shed light on the use of composite materials reinforced by knitted fabric compared with composite materials reinforced by woven fabric. Attachment materials used in our research is resin, while supported cloth either woven or knitted were manufactured from amplified polypropylene filaments (BCF), and the testing are (tensile strength, resistance to bending, shear strength, resistance to penetration). Comparing the results of composite material produced from knitted fabric shown better mechanical properties than woven fabric because of the knitted fabric distinct by the process of overlap between the stitches that gave better resistance.

Key Words: Composite material; Woven fabric; Knitted fabric.

1. INTRODUCTION

In recent years, use of composite materials supported by textile fibers is increased, because the intermingling between the inorganic fibers and organic materials gives the new material with good properties. As there are materials isn't similar at all but by merging with each other produces a strong correlation materials. Some yarns are still suffering of weakness in the resistance of the surface stresses resulting from use, and by adding the appropriate materials will be improved significantly, in the case of blending polypropylene fiber with thermoplastic materials will improve the mechanical properties of polypropylene fiber and recycle damaged thermoplastic materials [1-8]. The use of products made of composite materials backed with cloth was expand, where they are used in technical applications like space and civil engineering, also entered strongly in the shipping industry because of its qualities and useful in these industries [9]. Composite material which mainly consists of resin distinct in good mechanical properties [10], but it is very smashed material [11]. Polypropylene fibers (PP) mixed with attachment material (resin) give a new material with high bending resistance and penetration resistance, followed by polyester filament and nylon yarns [12]. Researcher [13] concluded that the addition of composite materials especially resin improves the properties of knitted cloth with a single jersey knit, made of glass fibers, were tensile test results of both the parallel and vertical direction

very approximate [14]. Tensile strength was improved after addition of composite materials for knitted cloth made of polyethylene or polypropylene fiber or fabric called UHMWPE (polyethylene fabric with a high specific weight), which fiber enhances the strength of the composite material [15]. The researcher [16] finds that there is a relationship between the temperatures of the composite material during pours it to knitted fabric and the amount of improvement in product properties, by increasing the temperature the product tensile strength improves and explained it to a good mix of fabric fiber with attachment material Research [17] compares between the two ways to add composite materials (resin) to single jersey knit fabric, first way is anoint the fabric with the composite materials, and the second way is inject composite materials to cloth by pressure. Research found that the latter way have shown better results for tensile test and shear strength resistance, because of the ability of the attachment material in the injection way by pressure to the penetration to all parts of cloth. Research found by microscopic examination of samples made by first way that cloth has air spaces within the samples lead to the formation of weak points and in turn lower product resistance. Samples made of several layers of woven fabric have good results of tensile resistance and energy absorption characteristics by way injection composite materials, than when using the method (film-stacked) paste layers with each other using composite materials [18]. Woven fabric with composite materials shows more penetration resistant than knitted fabric. Therefore [19] compares several samples of woven cloth made of polyester filament of yarns 300 den and heavily 30 thread per cm for both warp and weft, but different types of weaves, namely, (1/1 plain, 1/2 plain, 1/4 plain, 1/4 Satin). And found that the woven fabric with weave 1/1 supported by composite materials gives a greater resistance to penetration, and the reason is that this weaves is characterized by the largest number of interlacements between the warp and weft yarns. Bending resistance of the composite material by knit fabric has five times greater resistance than composite material by woven fabric [20]. Researcher [21] tested the behavior of two types of knit fabric made of fiberglass with composite materials under tensile test, two types are (Rib, Milano), testing was in both directions with rows and perpendicular to the rows, and found that the two types of cloth have greater resistance to perpendicular to the rows. The researcher [22] have tested the type of composite material produced from knitted fabric (Rib 1 * 1) with resin, under two types of tests shear and tensile, in three directions (0° ,

45°, 90°) and found that the product is have greater tensile resistance at 90°, either under shear test at 45° angle showed the best results.

2.The Aim of the Research and its Importance

The research aims to study the effect of supportive fabric type (either woven or knitted) on the mechanical properties of produced composite materials. While previous studies have not conducted comprehensive comparison between the two types of fabric, previous studies conducted one samples tested, while our research has been conducting a four tests (tensile strength, resistance to bending, shear strength, resistance to penetration), these tests which can determine the mechanical properties of the resulting material.

3.Materials and Methods of Search

Composite materials consist of the following basic materials.

1. Polyester resin
2. Strengthening material
3. accelerated material (cobalt)
4. PP yarn (to made woven or knit fabric)

4.Tested fabric

Woven fabric from plain weave 1/1 made of propylene filaments count 1200 den for both warp and weft, weight per square meter is 150 g/m².Knitted fabric from single jersey weave, made of propylene filaments count 1200 den, weight per square meter is 150 g/m².

5.Preparation of the attachment materials

Attachment materials made by adding accelerated materials (cobalt + catalyst) and mix it well until it's ready.

6.Coating the metal mold and wooden textured wax

So as to ease removal of samples processed and prevent it from sticking template metal, wait about half an hour until the foam and not to touch wipe oneself and only tarnished the first layer. Anoint attachment material on all farm accurately because the presence of any part is greased makes it difficult to separate the piece from the mold.

7.Adding the cloth

After making sure of the full-frame anointed completely, we put the fabric layer on the template, and then put attachment material through painted with a brush. Also using a roll pressure must be well to empty out of the air and the satisfaction of material do, and must work quickly so that material does not dry Association in an area without the other leading to conglomerate article Association and deformation piece and the loss in cost, especially when there is a metronome.

8.Retention period

After the completion of the development and cloth material piece Association leave for 24 hours to dry and hold together with each other and after this period by a screwdriver or other tool separate piece from the mold of the tip and then easily separate it by hand.

9.Composite materials tests

The tests that we will have are the resistance of tensile, bending, shear, and penetration, and each test we have cut composite materials to irregular forms of the test according to its ASTM.4.

10.Results

Three types of samples tested, namely, (resin, composite materials produced from woven fabric, composite materials produced from knitted fabric), mechanical properties are defined by four teststypes, namely, (tensile test, shear test, bending test, penetration testing), and the results were as below:

11.Tensile test

It has been relying to conduct this test on the system: (ASTM: D 3039/D 3039M-95a).

11.1.The purpose of the experiment:

Determine the tensile properties and that by drawing the relationship between stress and strain or between strength and elongation.

11.2.The test device: It consists of:

- Fixed jaw: Sticky key element is the center of a handle one load.
- Movable jaw: a moving element holds steady grip.
- Handles: It is in order to hold the sample and the sample placed between the handle and the handle fixed mobile.

11.3.The test specifications:

- Test speed=10 mm/min
- Sample thickness=3 mm
- The sample width=13 mm
- The distance between the jaws=100 mm
- The number of repeaters=10 samples

It determines the tensile test through three specifications, namely, (stress, strain, elongation), and with a table of the values of the arithmetic average of the results of tensile test specimens tests comes in Table 1. As it has been the comparison between the resistance woven cloth and woven fabric under tensile test, and the results were as follows:

12.Shear test

It has been relying to conduct this test on a system: (ASTMD790-95a).

12.1.The purpose of the experiment:

Determine the shear properties and that by drawing the relationship between the force and bending.

12.2.The test device: It consists of:

- Fixed jaws: Sticky key element is the center of a handle one load.
- Movable jaw: a moving element mediates jaws steadfast but from the top.

12.3.The test specifications:

Test speed=2 mm/d Sample thickness=4 mm

The sample width=13 mm

The distance between the jaws=35 mm

The number of repeaters=10 samples

It determines the tensile test through three specifications, namely, (load, bending, strain, stress), and with a table of the values of the arithmetic average of the results of the shear test samples tests comes in Table 2.

13.Bending test

It has been relying to conduct this test on a system :(ASTM D790-95a).

13.1.The purpose of the experiment:

- Determine the bending characteristics, and through drawing the relationship between the force and bending.
- Calculate the characteristics of a material through a curved and discuss the results.

13.2.The test device: consists of:

- Fixed jaws: increase the distance between the two jaws is the only difference from the shear test.
- Movable jaw: a moving element mediates jaws steadfast but from the top.

13.3.The test specifications:

Test speed=2 mm/min

Sample thickness=3 mm

The sample width=12 mm

The distance between the jaws=80 mm

The number of repeaters=10 samples

It determines the tensile test through three specifications, namely, (load, strain, deflection, stress), and with a table of the values of the arithmetic average of the results of test samples bending tests comes in Table 3.

14.Penetration test

It has been relying to conduct this test on a system: (ASTMD790-95a). 1. The purpose of the experiment:

Determine the bending characteristics, and through drawing the relationship between the force and bending.

14.1. The test device: It consists of:

- Fixed jaw: Sticky key element is the center of a handle one load.
- Movable jaw: a moving element mediates the upper jaw circular head.

14.2. The test specifications:

Test speed=3 mm/min
Sample thickness=3 mm
Qatar sample=50 mm
Qatar test head=11 mm
The number of repeaters=10 samples

It determines the tensile test through three specifications, namely, (load, strain, bending, stress), and with a table of the values of the arithmetic average of the results of penetration testing samples tests comes in Table 4.

15. DISCUSSION

We will compare the results of all tests of samples consisting of resin, composite material supported by woven fabric and composite material supported by knitted fabric. To identify the samples are characterized by better specifications.

15.1. Tensile test

Woven fabric exhibits a better tensile strength compared with knitted fabric before adding the attachment material, due to the structure of woven fabric (plain 1/1) based on a friction between threads, while as the structure of knitted fabric (single jersey) based on stitches are made from one yarn only. But after adding attachment material to knitted cloth, the tensile strength increases than woven cloth, due to fill the blanks in its structure, and on the other hand, because the test is perpendicular to the rows and not parallel to it, this gives better results depended to weave structure (single jersey) that we used.

15.2. Bending test

Attachment material falls down easily in bending test it very smashed material, on the other hand we cannot do this test for each of woven fabric and knitted fabric alone, because it are high drooping materials. But when the cloth unions with attachment material gave the new product, it have a high resistance of bending than it was for attachment material alone due to lower drooping of new material.

Resultant stress of composite material with knitted fabric is greater than the stress of woven fabric, that because of woven fabric drooping less than knitted fabric drooping, due to the structure of knitted fabric (single jersey) has a flexible behave more than the structure of woven fabric (plain 1/1). That resulting to increase product smash and collapses under the slightest of cloth value knitted. This corresponds with the results of the researcher [20].

15.3. Shear test

Attachment material has good resistance to shear its own, but after support it by either woven or knitted, stress increased in the produced material. The equal improvement between composite material from woven fabric and composite material from knitted fabric is explained of the test direction is to knitting direction leading to provide resistance knitted fabric greater than thread direction. This corresponds with the results of the researcher [12].

15.4. Penetration resistance test

A good result was shown when attachment material infiltrates between knitted fabric poles and links to poles to each other, and repeated the same case with woven fabric, where that attachment material infiltrates will enter spaces occurring between the warp and weft, and the product has a greater resistance to penetration. But this result conflicted with the result researcher experiments [22]. The reason for this is that the researcher used a woven yarn density greater than the knitted fabric.

16. CONCLUSION

Adding attachment material (resin) to woven or knitted fabric will give a new composite material, it has mechanical properties better than the properties of attachment material alone or cloth materials alone.

Comparing the composite materials obtained from woven fabric with composite materials obtained from knitted fabric, we find the following:

- Composite materials produced from knitted fabric shows better tensile resistance than composite materials produced from woven fabric. This is consistent with [14].
- Composite materials produced from knitted fabric shows better bending resistance than composite materials produced from woven fabric. This is consistent with [20].
- Composite materials produced from knitted fabric shows similar shear resistance to composite materials produced from woven fabric. This is consistent with [12].
- Composite materials produced from knitted fabric shows similar penetration resistance to composite materials produced from woven fabric. This is inconsistent with [19].

Table 1: Results of tensile test of all samples.

Tensile	Stress [N/mm ²]	Strain [%]	Elongation [mm]
Knitting fabric with composite material	172.114	4.298	172.114
Woven fabric with composite material	146.9	4.846	4.846
Knitting fabric	52.667	1.852	1.852
Woven fabric	77.433	2.054	2.054

Table 2: Results of shear test of all samples.

Shear	Load [N]
Resin	590.11
Knitting fabric with composite material	802.43
Woven fabric with composite material	788.97

Table 3: Results of bending test of all samples.

Bending	Load [N]
Resin	47.77
Knitting fabric with composite material	178.5
Woven fabric with composite material	141.13

Table 4: Results of penetration test of all samples.

Penetration	Load [N]
Resin	301.3
Knitting fabric with composite material	386.167
Woven fabric with composite material	393.2

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