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# Experimental Testing of Jute Aramid and Hybrids of Their Fibers Along with A Snail Shell Powder

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## ABSTRACT

*The composites have lot of advantages over the traditional glass fiber or mineral filled ceramic materials including low cost, light weight, eco friendliness and recyclability. In this thesis we use fibers called jute, aramid and jute/aramid fiber with epoxy (ly556) and polyester. By using the above mentioned three reinforcements are developed by the variation in the resin mixing. By the combination of all the three fibers we get jute, aramid and jute/aramid fiber with epoxy (ly556) hybrid composites as well as jute, aramid and jute/aramid fiber with polyester. The fabricated six samples are subjected to tensile, flexural, impact, and hardness determine the properties of these composite was made the crossover material which are assessed tentatively as per ASTM norms.*

*KEYWORDS: Jute fiber, aramid fiber, epoxy resin, polyster resin, snail shell powder*

## 1. INTRODUCTION

Composite materials are a significant type of materials which are presently accessible to humankind in huge amount. Lately, many glass reinforced by fiber composite materials are broadly utilized in the aviation and car businesses. Composite materials are significant for mechanical, chemistry and structural architects, material researchers for utilizing them on a lot of building and different applications. These materials have turned into the option of customary basic materials, for example, steel, wood or metals in numerous applications.

The technological development has increased on advances in the materials field. A random composite material is one, which consists of mixing the particles of the materials working together to produce new metal have properties which are dissimilar to the properties of singular material that they possess. It contains the most important characteristic that the materials are not soluble to each other. Likewise, the random composite material assume the role of the advancements designing material because of their fantastic mechanical properties while being lowweight, minimal cost, and profoundly adaptable. Composite essentially comprises a matrix which around the reinforce in this way the strength and durability is existed that is important in a specific field of utilization. Chopped strand mats are arbitrarily situated, give good strand, great wet ability, and scattering, and show even strength thought every which way. A researcher examined the investigation of mechanical properties of E-Glass fiber chopped strand material with epoxy resin nano clay composites; the point of this work is to dissect the impact of nano clay effect on the mechanical conduct of chopped strand E-glass fiber, strengthened in the matrix of epoxy with filler of nano clay.

**COMPOSITE** Composite comprises of different materials with distinct properties to create a superior and unique material. Composites are grouped by reinforcement or by types of matrix in which reinforcements are load carrying element whereas matrix material help them to keep in desired location and become load transfer medium between reinforcement and matrix[1]. Fiber reinforce composites are gaining interest in various application, but their growth is limited due to toughness. Hybridization of fiber is an approach to make composites toughen by combining different kind of fiber and these hybrid composites offer good mechanical properties compare to non-hybrids composites. Mingling of fiber in unit matrix, hybrid fiber reinforced composites offer wide range of mechanical properties.

Hybrid composites have several three main advantages over composites which made of using one type of fiber reinforcement. First, they provide new liberty to designer with some unique properties. Second, effective cost utilization of expensive fibers can be fetched by partially swapping them to least expensive fibers. Third, they provide diverse combination of mechanical properties like ductility, strength and stiffness. Also, hybrid composites are weight saving, improvement of fractural toughness, reduction in notch sensitivity, good impact resistance, longer fatigue life compared to composite which made of single reinforcement.

## APPLICATIONS OF COMPOSITE

Composite materials for construction, engineering and other similar applications are formed by combining two or more materials in such a way that the constituents of the composite materials are still distinguishable, and not fully blended. One example of a composite material is concrete, which uses cement as a binding material in combination with gravel as a reinforcement. In many cases, concrete uses rebar as a second reinforcement, making it a three-phase composite, because of the three elements involved.

The commercial application of composites promises to offer much largerbusiness opportunities than the aerospace sector due to the sheer size of transportation industry.Thus the shift of composite applications from aircraft commercial uses has been observed in recent years. Increasingly enabled by the introduction of newer polymer resin matrix materials and high performance reinforcement fibers of glass, carbon and aramid, the penetration of these advanced materials has witnessed a steady expansion in terms uses and volume. The increased volume has resulted in the expected reduction in costs. High performance FRP can now be found in such diverse applications as composite armoring designed to resist explosive impacts, fuel cylinders for natural gas vehicles, windmill blades, industrial drive shafts, and even paper making rollers. For certain applications, the use of composites rather than metals has in fact resulted in savings of both cost and weight. Some examples are cascades for engines, curved fairing and fillets, replacements for welded metallic parts, cylinders, tubes, ducts, blade containment bands etc.

## METHODOLOGY

I: Collecting data and information identified with regular filaments and manufactured strands.

II: arrangement of examples utilizing hand layup procedure

III: Conducting tensile, impact, hardness and flexural tests.

IV: Plot outlines for the outcomes and manual estimations are directed.

V: Identify better fiber among 6 blends.

VI: A completely parametric model of the wind turbine blade is made in CATIA programming.

VII: Model got in igs. Wind turbine blade and utilizing ANSYS 16.0(workbench), to acquire stress, strain and deformations.

VIII: Taking limits conditions and conducting static examination.

IX: Finally, we contrast better among these six outcomes acquired from ANSYS and looked at changed materials.

1. **Materials Used**
   - **Jute fibre**
   - **Aramid fibre**
   - **Epoxy resin**
   - **Polyester resin**
   - **Hardener**
   - **Snail shell powder**

## JUTE FIBER

Jute fiber is considered to be one of the most important fibers for the production of bio-composites and bio-plastics. Much research can be found studying the different mechanical properties of jute fiber, which have acceptable mechanical properties like tensile properties, specific strength, and modulus, hence increasing its potential use in different applications [4].

- 100% bio-degradable recyclable and thus environmentfriendly natural fiber with golden & silky shine
- the second most important and widely cultivated vegetable fiber after cotton
- high tensile strength with low extensibility this helps to make best quality industrial yarn and fabric for packaging
- very versatile natural fibers that has been used in raw materials for packaging, textiles, non-textile, and agricultural sectors
- Jute stem has very high volume of cellulose that can procured within 4-6 months, and hence it also can save the forest and meet wood requirement of the

## ARAMID

**Aramid** in full **aromatic polyamide**, any of a series of synthetic polymers (substances made of long chainlike multiple-unit molecules) in which repeating units containing large phenyl rings are linked together by amide groups. Amide groups (CO-NH) form strong bonds that are resistant to solvents and heat. Phenyl rings (or aromatic rings) are bulky six-sided groups of carbon and hydrogen atoms that prevent polymer chains from rotating and twisting around their chemical bonds. As a result, aramids are rigid, straight, high-melting, and largely insoluble molecules that are ideal for spinning into high-performance fibres. The bestknown aramids are Nomex a high-melting fiber made into flame-proof protective clothing, and Kevlar, a high-strength fiber made into bulletproof vests.

The development of aramids followed that of nylon, a related class of polyamides produced by reacting acids containing carboxyl groups ($CO_2H$) with compounds containing amino groups ($NH_2$). During the 1950s and 1960s, methods for extending this class to compounds containing carbon rings were devised by researchers at E.I. du Pont de Nemours & Company now DuPont Company in the United States. Particularly as developed by Paul W. Morgan and Stephanie L. Kwolek, these methods involved dissolving the acids and amines in suitable solvents and reacting them at low temperatures. In 1961 DuPont introduced Nomex, or poly-*m*-phenylene isophthalamide, a product of isophthalic acid chloride and *m*-phenylenediamine, and in 1971 it introduced Kevlar, or poly-*p*-phenylene terephthalamide, produced from terephthalic acid chloride and *p*-phenylenediamine.

## EPOXY RESIN:

Epoxy has great added substance properties alongside high mechanical strength, low shrinkage, synthetically safe, high dissemination thickness, low gooey and better electric protection limit[2]. The properties of Epoxy Resin are displayedin table below

**Table 1: Properties of epoxy resin**

| Property | Value |
|---|---|
| Compressive strength(Mpa) | 70@25C |
| Flexural strength(Mpa) | ≥45@25C |
| Tensile strength(Mpa) | ≥25 |
| Density(g/cm3) | 1.1±0.05 |
| Viscosity(poise) | 3-5@25C |

## Polyseter Resin

Iso resin is a wax free resin. This resin is generally used in mold making because of its extreme durability. Iso-phthalic polyester resin also can be used where superior water resistance is desirable.ISO Resin is a medium viscosity, medium reactive polyester resin based on Isophthalic acid and superior glycols. It exhibits good mechanical and electrical properties together with good chemical resistance compared to general-purpose resins.

ISO rapidly wets the surface of glass fiber in the form of cloth mat or chopped fiber to produce laminates and moldings. Its superior chemicals resistance towards most mineral and organic acids, solvents and oils make an ideal choice for making glass reinforced chemical process equipment, storage tanks, tankers, ducting, hoods etc. for handling chemicals at ambient temperature. Moulds, boats, and bathtubs etc can also be made

## TYPICAL APPLICATION

- Chemical Tanks/Pipelines Fume extractor
- Duct
- Hood
- Chemical equipment

- Tanker
- Boat

**HARDENER**

Hardener was used as a binder during the fabrication.

It has low viscosity, cure at room temperature, good mechanical strength and Good resistance to atmospheric and chemical degradation.Hardener used for present investigation for initiating gel formation is hardener HY951. The combination of epoxy LY556 and hardener which cures at room temperature, excellent adhesive strength, good mechanical and electrical properties[3]. The ratio of the epoxy and hardener are taken 10:1 that is 10 grams of epoxy and 1 gram of hardener.

**TYPES OF HARDENER**

The hardeners are classified into following types

- Aliphatic and Aromatic amines,
- A hydrides and Polyamides.

The size of hardener molecules is much smaller than the resin molecules. Therefore the viscosity of hardener is low compared to the resins.

**SNAIL SHELL POWDER**

The freshwater snails were collected from the selected ponds and lakes of Kolkata and Howrah, India, from time to time between 2017 and 2019 as per the requirement of the experiment by employing an insect net of 200 µm mesh size or hand-picking from the substratum. Following collection, the snails were brought to the laboratory for identification and maintenance. The identified snails101 were segregated and maintained in the laboratory until death, following which the shells were collected and used in the experiment. In the present study, the shells of the three common freshwater snails of India were used.

## 2. FABRICATION OF COMPOSITE SPECIMENS (HAND LAYUP)

Hand lay-up procedure is the straightforward and least expensive strategy for composite handling. The infrastructural need for this strategy is additionally insignificant.The standard test method for Mechanical properties of fiber-sap composites; ASTM-D790M-86 is used to as per the estimations [5]. The shape is ready on smooth clear film with 2 way tape to the necessary estimation. At that surface form is arranged keeping the 2 way tape on the unmistakable film.

Long fiber support is cut to the shape size and placed on the outside of a thin plastic sheet. The thermosetting polymer in fluid structure is then modified to the appropriate extent with a specified hardener (restoring expert) and poured over the outside of transparent.

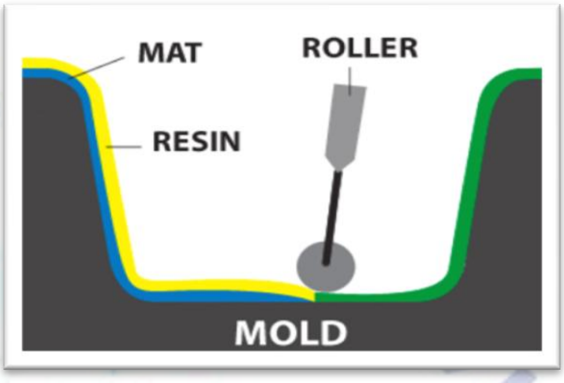
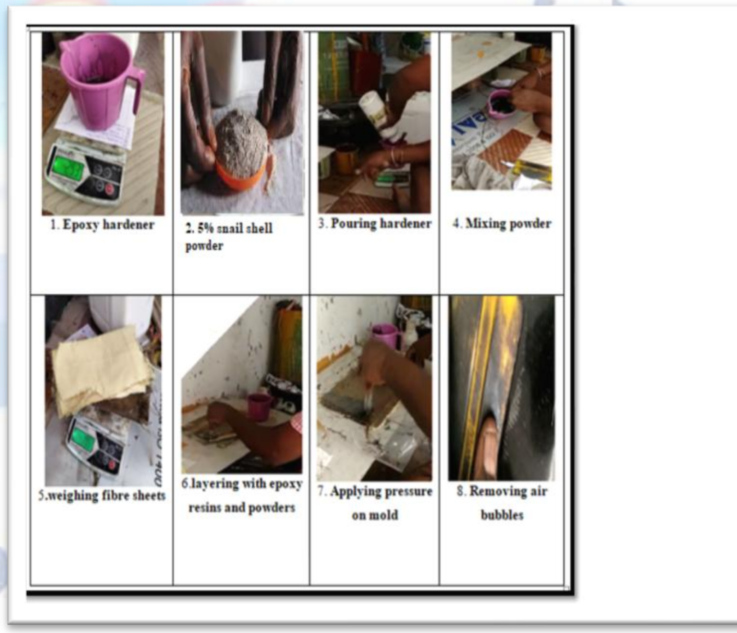



**Fig. 1**: Fabrications of composite specimens

With the help of a brush, the polymer is evenly distributed. Then second layer of fiber is placed on the polymer surface and another layer of polymer is applied after this is closed with another thin plastic sheet after squeezer is moved with a gentle pressure on the thin plastic sheet to remove air .The consequential mold is cured for 24 hours at room temperature.

**Fig. 2**:Complete sequential process for fabrication




## 3.STEPS INVOLVED IN THE FABRICATION OF SPECIMEN:

The jute, aramid and jute/aramid fiberspecimen was fabricated by hand layup technique. In this process 6 sheets of 300GSM Aramid fibre along with Jute

(230/300mm) and 10 grams of hardener (HY951) is mixed with 100 grams of Epoxy (LY556) and Poly ester which is used as matrix in the composite. In all compositions of fibres likely to be used 5% of snail shell powder. The thickness of the specimen is 4.5 mm for tensile test and flexural test. Thickness of the specimen that obtained by1 sheets of 300GSM of Chopped mat fibre is around 1mm. For obtain 4.5 mm thickness six sheet of Chopped mat are used. And the thickness of specimen for impact test is 4.5 mm.

- **ARAMID FIBRE WITH EPOXY RESIN5% OF SNAIL SHELL POWDER** reinforced Epoxy Composite specimen was fabricated by hand layup technique. In this process 6 sheets of 300GSM Aramid fibre (230/300mm) and 10 grams of hardener (HY951) is mixed with 100 grams of Epoxy (LY556) which is used as matrix in the composite. Snail shell powder processing. The thickness of the specimen is 4.5 mm. Thickness of the specimen that obtained by 1 sheets of 300GSM of Aramid fibre is around 1mm. For obtain 4.5 mm thickness six sheet of Aramid are used. And the thickness of specimen for impact test is 6mm for obtain this 6 sheets of Palm are used.
- **JUTE FIBRE WITH EPOXY RESIN5% OF SNAIL SHELL POWDER** reinforced Epoxy Composite specimen was fabricated by hand layup technique. In this process 6 sheets of 300GSM Jute fibre (230/300mm) and 10 grams of hardener (HY951) is mixed with 100 grams of Epoxy (LY556) which is used as matrix in the composite. In all compositions of fibres likely to be used 5% of snail shell powder. The thickness of the specimen is 4.5mm. Thickness of the specimen that obtained by 1 sheets of 300GSM of Jute fibre is around 1mm. For obtain 4.5 mm thickness six sheet of Jute are used. And the thickness of specimen for impact test is 4.5 mm for obtain this 6 sheets of Jute are used
- **JUTE/ARAMID FIBRE WITH EPOXY RESIN5% OF SNAIL SHELL POWDER** reinforced Epoxy Composite specimen was fabricated by using hand layup technique. In this process 3 sheets of 300GSM jute fibre (230/300 mm) and 3 sheets of 300GSM Aramid fibre (230/300 mm) the 4.5 mm thickness. And 10 grams of hardener (HY951) is mixed with 100 grams of Epoxy (LY556) which is used as matrix in the composite. In all compositions of fibres likely to be used 5% of snail shell powder. The thickness of the specimen for tensile test and flexural test is 4.5 mm. The thickness of specimen for impact test is 4.5 mm
- **ARAMID FIBRE WITH ISO-POLYESTER RESIN5% OF SNAIL SHELL POWDER**reinforced iso-polyester resin Composite specimen is fabricated by hand layup method. For this iso-polyster with accelerator and catalysts are used. In this process 6 sheets of 300GSM Aramid (230/300 mm). In all compositions of fibres likely to be used 5% of snail shell powder. The thickness of the specimen for tensile test and flexural test is 4.5 mm. The thickness of specimen for impact test is 4.5 mm to obtain these thickness 4.5 sheets of 300GSM.
- **JUTE FIBRE WITH ISO-POLYESTER RESIN5% OF SNAIL SHELL POWDER** reinforced iso-polyester resin Composite specimen is fabricated by hand layup method. For this iso-polyster with accelerator and catalysts are used. In this process 6 sheets of 300GSM Jute (230/300 mm). In all compositions of fibres likely to be used 5% of snail shell powder. The thickness of the specimen for tensile test and flexural test is 4.5 mm. The thickness of specimen for impact test is 4.5 mm to obtain these thickness 4.5 sheets of 300GSM.
- **JUTE/ARAMID FIBRE WITH ISO-POLYESTER RESIN 5% OF SNAIL SHELL POWDER** reinforced iso-polyester resin Composite specimen is fabricated by hand layup method. For this iso-polyester with accelerator and catalysts are used. In this process 3 sheets of 300GSM Jute (230/300 mm) and 3 sheets of 300GSM Aramid (230/300 mm). In all compositions of fibres likely to be used 5% of snail shell powder. The thickness of the specimen for tensile test and flexural test is 4.5 mm. The thickness of specimen for impact test is 4.5 mm to obtain these thickness 4.5 sheets of 300GSM

## 4.TENSILE TESTING OF COMPOSITES

A 2 ton limits electronic tensometer , METM 2000 ER-1 model (Plate II-18), supplied by M/S microtech Pune, is used to determine the elasticity of composites[6]. Its capability can be changed by burden cells of 20 kg, 200 kg and 2 ton. A burden cell of 2 ton is used for testing composite specimens. Self-adjusted brisk grasp throw is used to hold composite specimens. A computerized micrometer is used to measure the required thickness and width of composite specimens. The gauge length, width and thickness are measured with 0.001 mm minimal tally computerized micrometer. This electronic tensometer is fixed with burden and augmentation pointers, which has a minimal tally of 0.01 kg and 0.01mm individually. An electronic tensometer is fitted with an altered self adjusted snappy grasp toss and other versatile self adjusted fast hold toss to hold 165 mm long, 12.5 mm wide and 4 mm thick specimens. Specimens are placed in the grips of a tensometer at a specific grip separation and subjected to load until failure. The force applied is varied on toquantify the heap and expansion of specimen. The flexible throw is further moved such that the heap pointer just begins giving evidence stacking on the specimen.


**Fig3:** Electronic tensometer for tensile & flexural testing

Right then and there the expansion meter is acclimated to peruse zero, when the heap on the example is zero. The pace decrease pulleys are picked such that the cross head velocity of 0.2 mm/min is connected on portable hold. At that point the electronic engine fitted to tensometer is begun. Starting from zero, at each 0.5 mm expansion the heap pointer are noted until the specimen breaks. At the end of test the final load and extension is additionally noted from the electronic pointer display. For every specimen the kind of failure and other perceptions relating to failure are listed. Two indistinguishable specimen samples are examined. The tensile stress are determined by the following relation

$$\text{Tensle stress } \sigma = \frac{tensile\ load}{Area\ of\ cross\ section}$$

$$= \frac{P}{A} \text{ N/mm}^2$$

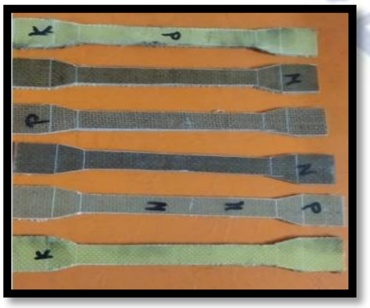


**Fig.4:** Tensile test specimen

**FLEXURAL TESTING OF COMPOSITES**

Three point bowing test are carried out as per ASTM-D790M-86 test procedure 1, system A to extract flexural properties, the specimens are 100 mm long , 25 mm wide and 4.5 mm thick . Two indistinguishable specimens are subjected for flexural testing. In three point bowing test, the external rollers are 70 mm separated and specimens are subjected at a strain rate of 0.2 mm/min. Flexural stress are determined by the following relations.

$$\text{Flextrualstress } S = \frac{3\,P\,L}{2\,b\,t^2}$$

P= load in N

L= length between supports (70mm)

b= Width in mm

d= Thickness in mm

**Fig.5:** specimen's flexural test

**IMPACT TESTING OF COMPOSITES**

Impact test is also known as charpy v notch, Impact tester was sway analyzer supplied by M/S International Equipments, Mumbai, was used to test the impact properties of fiber Reinforced composite specimen. The Impact tester has four working abilities of effect quality i.e. 0-2.71 J.0-5.42 J,0-10.84 J and 0-21.68 J, with a base determination on every size of 0.02J, 0.05 J, 0.1 J and 0.2 J individually .Four scales and comparing mallets (R1,R2,R3,R4) are presented in equipment.

Standard test procedure, ASTM D256-97, for effect properties of fiber composites has been used to examine the unidirectional composite specimens [7]. The specimens to be examined are of dimensions 63.5mm long, 12.36mm wide and 6mm in thick. A V-point is placed in impact tester record having an included point of 450 at the focal point of the specimen, and at 90¬0 to the specimen pivot. The profundity of the specimen to be examined under the indent is 2 mm.

The examination assembles with ASTM standard gauges. Based upon the volume portion of the specimen, one of the four sledges (R1, R2, R3, and R4) must be chosen to break the specimen. The sledge is fixed to the pendulum as shown in figure 13.4 in a specific manner that it will reach the specimen on a line 22mm over the top surface. The specimen is fixed to the anvil and hammer is used to break the specimen. The pendulum sledge is released from locking position which is at a point of 1500 and hits the specimen with a striking speed of 2.46m/sec. The specimen is stripped and energy is demonstrated in joules by the pointer on the particular scale.


**Fig.6: Impact machine for impact testing**

Impact strength was calculated by the following relation

$\sigma = \frac{2P}{A}$

P= Energy observed in J

A= Area in mm

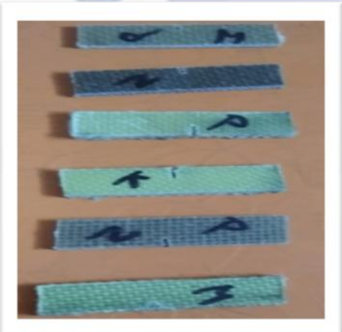


**Fig.7:** before testing impact testing

**HARDNESS TEST** Hardness properties According to ASTM D 785 standards for composites, the specimens were prepared for Rockwell-B hardness test, the specimen is of 25mm diameter and a length of 20mm.Fiber configuration and volume fraction are two important factors that affect the properties of the composite.

**Fig.8**: Hardness testing machine

In this test, the configuration is limited to unidirectional and continuous fibers equal to the length of the specimen. The hardness properties of the composites are studied by applying indentation load normal to fibers diameter and normal to fiber length. The effect of fiber loading and post curing time on Rockwell hardness is illustrated. Generally, fibers that increase the module of composites increase the hardness of the composite. This is because hardness is a function of the relative fiber volume and modulus [8].

**Fig.9:** before testing's hardness test

## RESULTS AND DISCUSSION

**Table 2: Specimens testing results – Tensile Test**

| S.No | Composite | Tensile Test(Mpa) | |
|---|---|---|---|
| | | Load (N) | Elongation (mm) |
| 1 | Aramid(iso polyester resin) | 8150 | 5.4 |
| 2 | Jute(iso polyester resin | 1720 | 1.3 |
| 3 | Aramid+jute(iso polyster resin) | 6225 | 4.2 |
| 4 | Jute(epoxy resin | 2050 | 1.7 |
| 5 | Aramid(epoxy resin) | 9810 | 5.6 |
| 6 | Aramid+jute(epoxy resin) | 11200 | 6.1 |

**Table 3: Specimen Testing Results – Flexural Test**

| S.No | Composite | Flexural stress(Mpa) | |
|---|---|---|---|
| | | Load(N) | Elongation(mm) |
| 1 | Aramid(iso polyester resin) | 370 | 7 |
| 2 | Jute(iso polyester resin | 430 | 1.95 |
| 3 | Aramid+jute(iso polyster resin) | 1050 | 7.8 |
| 4 | Jute(epoxy resin | 380 | 2.1 |
| 5 | Aramid(epoxy resin) | 520 | 4.3 |
| 6 | Aramid+jute(epoxy resin) | 1105 | 5.6 |

**Table 4:** Impact and Hardness Test

| S.No | Composite | Impact test | Hardness number |
|---|---|---|---|
| | | (j) | |
| 1 | Aramid(iso polyester resin) | 2.5 | 106 |
| 2 | Jute(iso polyester resin | 1.3 | 63 |
| 3 | Aramid+jute(iso polyster resin) | 5.8 | 97 |
| 4 | Jute(epoxy resin | 1.2 | 80 |
| 5 | Aramid(epoxy resin) | 5.9 | 120 |
| 6 | Aramid+jute(epoxy resin) | 6.6 | 132 |

The properties of the jute, aramid and jute/aramid fiber with Epoxy (LY556) and Polyester reinforced epoxy hybrid composites with of fiber under this investigation are presented in the table. I have taken each composite for each test. In every combination commonly 5% of snail shell powder is used. Details of processing of these composites and the tests conducted on them have been described in the previous topic. The mechanical properties of Synthetic fiber reinforced composites are largely depends on the chemical, structural composition, fiber type and soil conditions and also on atmospheric conditions at the time of fabrication of the specimens.

The results of various characterization tests are reported here. This includes evaluation of tensile strength, flexural strength, and impact strength and hardness test. Has been studied and discussed. Based on the tabulated results one composite is taken which has more strength among the others.

## INTRODUCTION TO ANSYS

ANSYS is a large-scale multipurpose finite element program developed and maintained by ANSYS Inc. to analyze a wide spectrum of problems encountered in engineering mechanics.

## PROGRAM ORGANIZATION:

The ANSYS program is organized into two basic levels:
Begin level:
Processor (or Routine) level

The Begin level acts as a gateway into and out of the ANSYS program. It is also used for certain global program controls such as changing the job name, clearing (zeroing out) the database, and copying binary files. When you first enter the program, you are at the Begin level.

At the Processor level, several processors are available. Each processor is a set of functions that perform a specific analysis task. For example, the general pre-processor (PREP7) is where you build the model, the solution processor (SOLUTION) is where you apply loads and obtain the solution, and the general postprocessor (POST1) is where you evaluate the results of a solution. An additional postprocessor, POST26, enables you to evaluate solution results at specific points in the model as a function of time.

## MESH AND BOUNDARY CONDITIONS:

The meshed model of wind turbine blade of nodes =2280 and elements is 480 Using Material as finalized material from above mentioned Aramid with Jute call it as a hybrid and existing material for wind turbine blade Al6061.

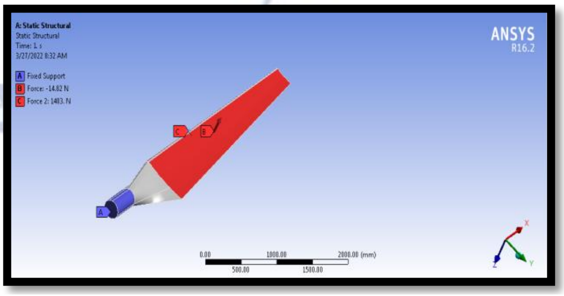



**Fig. 10:Boundary conditions at static condition**

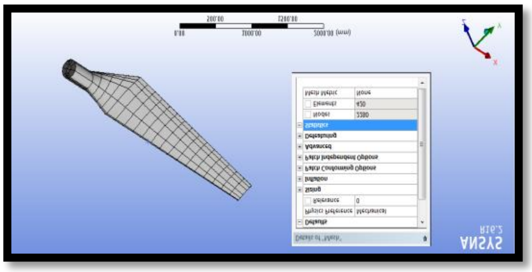


**Fig.11:** MESH: Nodes: 2280, Elements: 420

**Static Analysis of Aramid/Jute fiber + 10% snail shell powder**

Using Material exisisting for wind turbine blade Aramid/Jute of epoxy resin material with of 10% of snail shell powder for static analysis. In order to determine the stress, total deformation, shear stress results with aid of the ANSYS 16.0 software are discussed below,

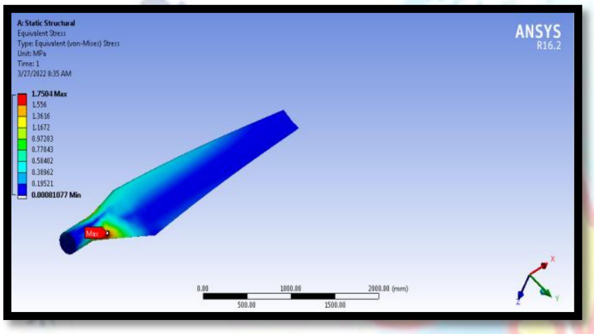



**Fig. 12: Von-misses stress of Aramid/jute fiber + 10% snail shell powder**

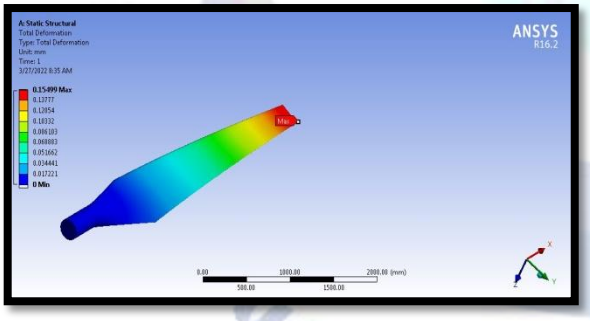



**Fig. 13: Total deformations of Aramid/jute fiber + 10% snail shell powder**

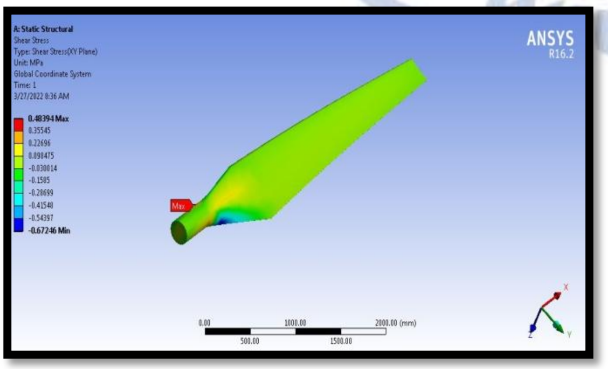



**Fig.14**: Shear Stress of Aramid/jute fiber + 10% snail shell powder

**Static Analysis of AL 6061 Material:**

Using Material AL 6061 for static analysis is carried out on wind turbine blade. In order to determine the stress, total deformation, shear stress results with aid of the ANSYS software are discussed below,

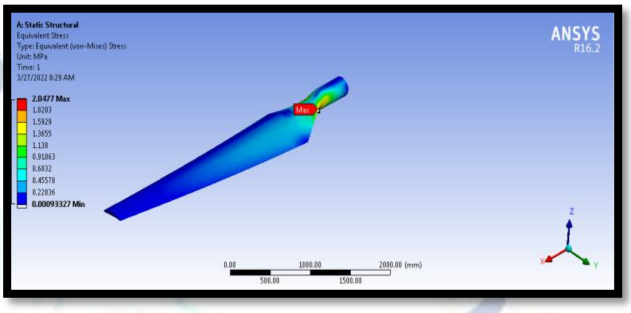



**Fig. 15: Von-misses stress of Al 6061 Material**

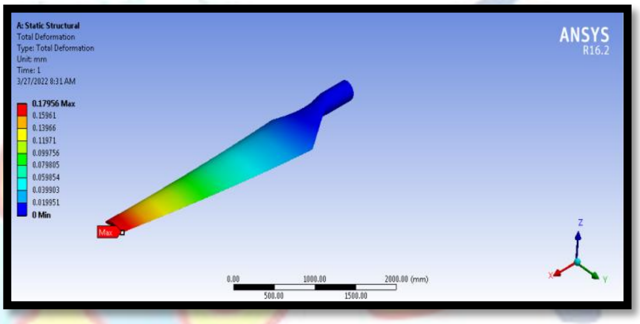



**Fig. 16:Total deformations of Al 6061 Material**

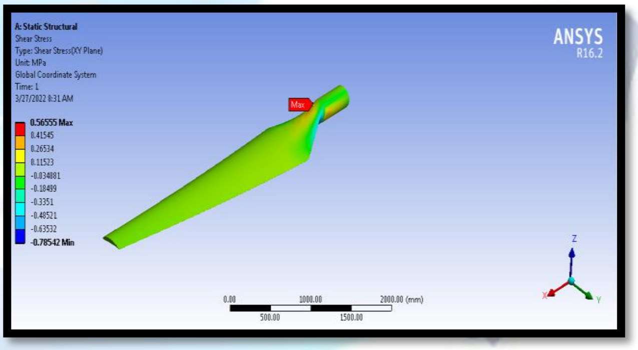



**Fig. 17: Shear Stress of Al 6061 Material**

## CONCLUSION

The present work has been done with an objective to explore the use of jute, aramid and jute/aramid fiber with Epoxy (LY556) hybrid composites as well as jute, aramid and jute/aramid fiber with iso-polyesterare manufactured using hand lay-up method. In every combination 5% of snail shell powder to be used. The reinforced composite and investigated the mechanical properties like tensile, flexure, impact and hardness number of composites.

This work is focused to find the best composite among the six combinations. After all the tests has performed on the specimens Aramid with jute epoxy resin combination shows a best result in the tensile strength impact strength, hardness test and as well as flexural strength . For the above investigations we are proposed the aramid with jute of 5% snail shell powder with epoxy resign having good mechanical properties when comparing with other results. A fully parametric model of a wind turbine blade of exisisting AL6061 material is being analyzed by using the proposed material. After conducting static structural analysis on wind turbine blade finally proposed material shows excellent results comparing with the AL6061 material.

**FUTURE SCOPE**

- The extension of this thesis work can be done by considering the following points:
- The fiber can also take in the form of powder to fabricate the specimen which may increases the strength.
- Different type resins can be used to find the mechanical properties like strength, wear resistance by considering different process parameter and different composites which improves the properties of composites.

**Conflict of interest statement**

Authors declare that they do not have any conflict of interest.

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