REVIEW ON INTERFACE OPTIMIZATION AND MECHANICAL BEHAVIOUR OF NATURAL FIBRE COMPOSITE

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Abstract - *Now, the mechanical behaviour of composite fibre is concentrating on alternate material sources that are improved the mechanical behaviour. The expanding natural concerns, bio composite produced out of regular fiber and polymeric resin, is one of the advancements in constitutes the present extent of experimental work. The use of composite materials field is increasing gradually in material engineering. The composite consists of mainly two phases i.e. matrix and fiber composite. Fiber reinforced polymer composites has numerous preferences, generally the effort of creation is simple to create and better quality contrast than perfect polypropylene due to this reason fiber strengthened polymer composite. This work describe the mechanical behavior of fiber reinforced polymer composite at varying composition (25%, 30%, 35%) with an silicon carbide at 4%, 8%, 12% respectively. Also the test such as the compressive test, hardness test and the bending test are carried out and the mechanical properties of the composite material.*

Key words: *Natural fibre, Silicon carbide.*

1. INTRODUCTION

1.1 Definition of composite

The fiber composite materials are widely multifunctional characteristics for any discrete material. Widely the addition of silicon carbide to improve the properties of an material. Natural fibers are environmentally friendly, fully biodegradable, cheap and have less density. Currently, many types of natural fibers have been investigated for using the fibres, hemp, etc. The structures are physically combining of two or more composite characteristics are sometime. A mixture of materials either specific, wide variety of properties can be achieved through proper selection of fiber type fiber orientation and fiber reinforcement form. In terms of strength to resistance to heat desirable quality is better than composite alone advantage of attributes.

In recent times, light weight and high strength materials have been developed the industries and domestic applications. Most of the components of automobiles, aerospace, domestic appliances and packaging industries need waterproof, reasonably good strength and corrosion resistant materials to fight against environmental attack. Under the polymeric composites play a very important role in such applications due to its light weight, high strength, of composite in heterogeneous materials, of microscopic scale.

1.2 COMPOSITE MATERIAL

SILICON CARBIDE: Silicon carbide (Sic) is a compound of silicon and carbon with chemical formula. Heating elements for industrial furnace is wear resistance parts from pumps and light emitted diodes. The grains of silicon carbide can be bonded with sintering to form very hard and widely used in applications requiring high endurance. Electronic applications of silicon carbide such as light-emitting diodes. Sic is used in semiconductor electronics devices that operate at high temperatures. Silicon carbide with high surface area can be produced from SiO_2 contained in the material.

The simplest manufacturing process is to combine silica sand and carbon in an graphite electric resistance furnace at a high temperature, between 1600 °C. The SiO_2 particles in plant material can be converted to SiC by heating in the excess carbon from the organic material. The silica fume, which is a byproduct of producing silicon metal and ferrosilicon alloys, also can be converted to SiC by heating with graphite at 1500 °C. The material formed in the furnace varies in purity, according to its distance from the graphite resistor heat source. Colorless, pale yellow and green crystals have the highest purity and are found closest to the resistor. The color changes to blue and black at greater distance from the resistor, and these darker crystals are less pure. Nitrogen and aluminium are common impurities, and they affect the electrical conductivity of SiC.

Pure silicon carbide can be made by process, in which SiC powder is sublimated into high-temperature species of silicon, carbon, silicon dicarbide (SiC_2), and disilicon carbide (Si_2C) in an argon gas ambient at 2500 °C and redeposited into flake-like single crystals. This process yields high-quality single crystals, mostly of 6H-SiC phase. Cubic SiC is usually grown by the more expensive process of chemical vapor deposition relative to the CVD process is the advantage of material.

Merits of composites

- The composites of their conventional parts it may able to design the significant of weight saving as ratio.
- Due to the tensile strength of the composite is 2-4 times better than aluminium or steel.
- Improvement of properties and torsional and higher fatigue limit, at 50% of tensile strength.
- The composites are reduce the noise at low vibration than metals.
- Life of their fatigue can reduced in impact resistance of material.

Composite materials can be classified into 3 groups namely, They are:

1.Metal matrix composite.
2.Ceramic matrix composite.
3.Polymer matrix composite.

Metal matrix composite:

Metal matrix composites are higher specific modules in better properties at elevated temperature and higher strength. Mainly applicable for heat exchanger and structural microscopic form.

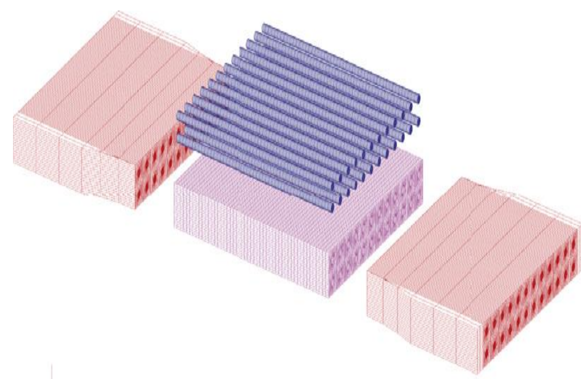
Ceramic matrix composite:

It must improve toughness at naturally among the improvement of strength and stiffness of matrix material.

Polymer matrix composite:

Mechanical properties of the polymer composites are structural purpose. Polymer composites are involved at high pressure and temperature.

2. EXPERIMENTAL PROCEDURE



It is one type of molding and fibre composition of material processes. Fibre and other reinforcing materials are manually in the open mold, and resin is poured, brushed, or sprayed over and into the glass plies. Entrapped air is removed manually with squeegees or rollers to complete the laminates structure. Room temperature may be epoxies at the most commonly used matrix resins. Curing is initiated by a catalyst in the resin system, which hardens the fiber reinforced resin composite without external heat. For a high quality part surface, a pigmented gel coat is first applied to the mold surface.

The processing steps are simple in process. First of all, a release gel is sprayed on the mold surface to avoid the sticking of polymer to the surface. Thin plastic sheets are used at the top and bottom of the mold plate to get good surface finish of the product. Reinforcement in the form of woven mats are cut as per the mold size and placed at the surface of mold. The polymer is uniformly spread with the help of brush. Second layer of mat is then placed on the polymer surface and a roller is moved with a mild pressure on the mat-polymer layer to remove any air trapped as well as the excess polymer present. The process is repeated for each layer of polymer and mat, till the required layers are stacked. After curing either at room temperature at some specific temperature.

The time of curing depends on type of polymer used for composite processing. This method is mainly suitable for thermosetting polymer based composites. Capital and infrastructural requirement is less as compared to other methods. Production rate is less and high volume fraction of reinforcement is difficult to achieve in the processed composites. The method finds application in many areas like aircraft components, automotive parts, boat hulls, dies board.

2.1 Fabrication of composites

During the material composition, addition of carbides an resin at weight ratio of 7:5 of combination. Some amount of wasted particles can be removed under the fiber and they maintained at room temperature at drying. Widely addition of carbides and composites to improve the tensile and hardness.

Preparation of material, they mould at carbides and laminated fibers. Specially designed at particular dimensions at 150 * 150 mm component size. The fibres are unidirectionaly in the mold. The upper and lower mold are pressed slightly to remove extra resin out it. Specimens are flexural and cut in sheet for further testing.

3. MATERIAL CHARACTERIZATION

Typical properties of Materials:

Property	Fibre	Epoxy	SiC
Density(Kg/m 3)	1350	1200	3210
Youngs modulus(Gpa)	3.48	1.359	188
Poissons ratio	0.28	0.3	0.28

Tensile Strength:

The tensile strength is an stress level at which plastic deformation starts. The beginning of first plastic deformation is called yielding. The stress at which plastic deformation is observed to begin depends up on sensitivity of the strain measurements. With most materials there is a gradual transition from elastic to plastic behavior, and the point at which plastic deformation begins is hard to an precision.

Ductility:

Ductility is the degree of plastic deformation that a material can withstand before fracture. A material that experiences very little or no plastic deformation upon fracture is termed brittle.

Bending test:

The three point bending flexural test provides values for the modulus of elasticity in bending, flexural stress, flexural strain and the flexural stress-strain response of the material. The main advantage of a three point flexural test is the ease of the specimen preparation and testing. The purpose of the bending test is to get an idea of the stiffness the bending stiffness of materials.

Hardness test:

Hardness is a measure of how resistant change in, solid matter is to various kinds of permanent shape change when a compressive force is applied.

4. LITERATURE REVIEW

The mechanical behaviour of a natural fiber based polymer composite depends on its fiber length and quality, matrix, fiber-matrix composition. The stronger interface between fiber and matrix is improvement among the mechanical properties. The effect surface treatment on the chemical properties of banana fiber and reported that treated banana fiber give higher shear stress and tensile strength when compared with the untreated fiber (1). An improvement of the surface and sub-surface degradation of multidirectional fiber and have given many conclusion such as under sliding , the most simple degradation was detected on sliding in anti-parallel direction(2). The uncertainty of properties along with ultimate tensile strength value maximum at 18% and decreases with increasing in fiber starting from 18% to 20%. Also may reported that an flexural strength value decreasing from 5% to 10% (40 M.Pa) and after that the value increased from fiber(3). An thermal composite behaviour is influence of fiber length on the mechanical and physical properties of nonwoven short banana, random oriented fiber and epoxy composite and they described that the tensile properties and percentage elongation of the composite attained a maximum in composite fabricated from 15 mm fiber length. They impact energy has the compressive strength increases ,decreased with increasing fiber length, also the mean flexural properties of the composite increased with increasing in fiber length up to 25mm. The banana fibers characteristic depending on the variation of diameter, mechanical characteristic and the effects of the stresses performing on elongation the fracture. The stress-strain curves for changed strain rates were found and fractured surfaces were inspected by SEM(4). The influence of fiber content and length on fiber cloth reinforced polymer composite material. Physical and mechanical behavior of fiber reinforced polymer composite and noticed that has better flexural strength(5). The stress and strain is detected maximum at 30 mm fiber length whereas the impact strength is noticed maximum at 40 mm length of fiber. Consolidation of 40% untreated banana fibers gives 20% rise in the tensile strength and

70% rise in impact strength(6). Configuration of an composites material having 20% treated fiber loading possess maximum values for above-mentioned properties than untreated composites, 10% and also 30% treated fibers composites. The interfacial area having main role in influential the strength of polymer material since fiber procedures a separate interface with the matrix. At an short zig-zag fiber composites with great rigidity and element mechanical properties might be effectively ready utilizing banana fiber as reinforcement in a polyurethane matrix inferred from castor oil. The treated banana fiber demonstrated higher shear stress and tensile strength when contrasted with the untreated fiber, showing a solid association between the treated strands and the polyurethane matrix(7). The reinforcement in the composite shows more flexural quality when contrasted with singular kind of characteristic strands strengthened composites. All the composites shows expand in flexural quality in longitudinal heading(8). The maximum flexural modulus, of magnesium matrix is laminar shear quality and break burden values. There are evaluated the mechanical, chemical and physical behavior of fiber reinforced with epoxy composite. Many studied and compared of effect of treated and untreated banana fiber reinforced with thermoplastic and thermosetting polymer. With a microstructural of material in casting of component(9).The thermal behavior of phenol composites which was reinforced with glass fiber and banana fiber. Carbon fiber reinforced polymer composites and reported that the brittle materials demonstrate interlinear splitting throughout weariness. The disappointment of this material was dictated by a restriction of disappointment. The banana and glass fiber bio-composites may be fabricate for outdoors and indoors applications wherever high strength additionally it can considered as the replacement to wood materials and protect the forest resources(10). A very generic definition of textile material is 'any material that involving fibrous material' and from this definition, there are three hierarchical system to categories textile material. the established method of fabrication limits the usage of yarn and there is a need of fabrication process using this kind of textile material other than filament winding to ensure the varieties of end products of yarn reinforced composite(11).The saline treatment composite are higher strength and young modulus while maintaining the elongation at break point increases with different in water absorption composite(12). The improvement to compared the previous composites structure in fibre was significant. In addition of the concept of stress is shearing the phenomenon of high ultimate strength needed to carry the normal activities(13). The modulus and tensile stress at a treatment of dynamic mechanical testing on strength of composite(14) Natural fibres have well prospective as reinforcements in polymer composites. Due to high specific properties and low density of natural fibres. This possesses good mechanical properties and these fiber composites can also be used in different applications(15). This treatment modifies the surface by disruption of hydrogen modification in the network structure. Silane is another commonly used chemical treatment as coupling agent for natural fibers. Alkaline treatment is among commonly used chemical treatments used on natural fibers to reinforce thermoplastic and thermoset matrices(16). Carbon fiber reinforced materials have been widely developed in metal matrix composites (MMCs) in the last decades, since they can endow MMCs good performance of thermo stability, wear resistance and fatigue resistance(17). The improved model is used to evaluate geometrical effects on the fatigue life of a composite structure under multiracial loading(18). Carbon fiber reinforced polymer composites and reported that the brittle materials demonstrate interlinear splitting throughout weariness. The disappointment of this material was dictated by a restriction of disappointment(19).Advanced continuous fibers have produced a revolution in the field of structural materials and composites in the last few decades because of their high specific strength, specific modulus, stiffness, and continuity, which meant processing and alignment are economically feasible(20).The efficiency of an load can transfer is determined by interaction at the interface along with the thickness and strength of the interfacial region formed(21).The reinforcing fibres will improved an compressive strength of the hybrid structure, between the wire and the matrix alone provides an lesser strengthening than the load transfer of the metallurgical bonded interface(22). In addition of mechanical properties, can be 49% weight savings of result of the reduced composite density. The research in this paper also found that traditional micromechanical models by means for predicting composite properties. It was determined rule has on average a 10% over estimation from experimental(23). The chains of molecules are joined end to end forming even longer chains, leaving only a few open chain ends, thus providing only a small amount of bonding points at the surface. Small amount of bonding points cause the low adhesion and wettability, problem in converting processes(24). This means act efficiently as nucleating agents. They can be interpreted in terms of the transient crystalline increase with an presence of fibres(25).

5. RESILT AND DISCUSSION

Tensile test:

The tensile test be carried out the temperature at 23°C with an relative humidity of 40%. In the testing machine with 50KN load was employed. The samples were tested in composite type of specimen. A composite with three different layers of higher strength of polypropane in better mechanical strength is higher improvement. The arrangement of raw and yarn, is unidirectionally of longitudinal axis of tension in load direction.

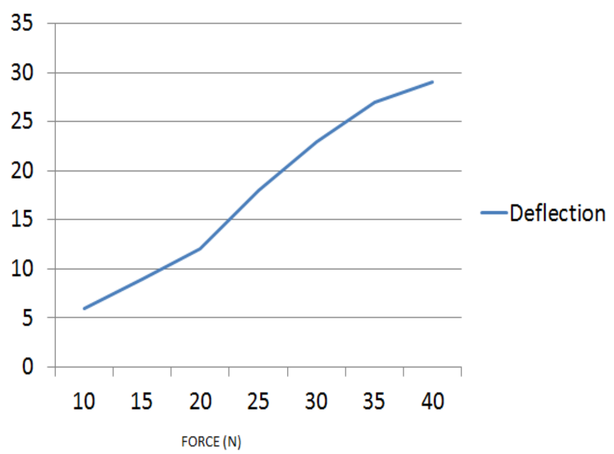


Chart-1: Tensile Test

Microstructural behaviour:

The tensile fractured surfaces of specimen in polymer composite. The matrix composite and potential failure of mechanisms were studied. This analysis of performance can be an model of material behaviour in some magnification.

Flexural test:

A pointing of bending test was conducted on no of specimens at every room temperature of an component. The specimens are tested based up on material.

Thermal property:

The first and second peaks, PP- based composite in existence of crystallization consequence is increased at 60%.

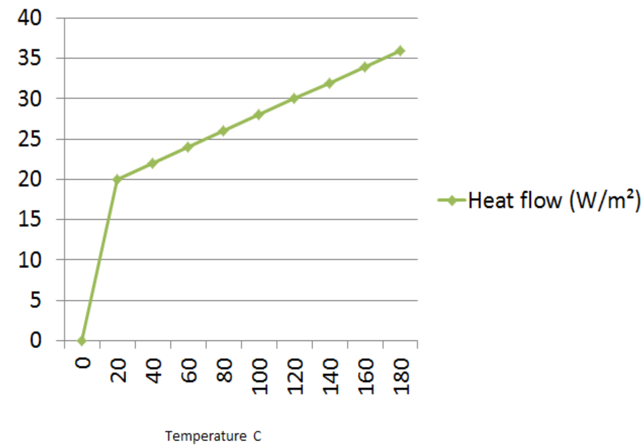


Chart-2: Thermal Property

Bending test properties:

A force of deflection in PP and its composites with filler materials. They increase in modulus of elasticity up to filler loading of 15%, 25% and 45% respectively. With a general observation of Hassan and reinforce polyester. An application of desire at rather energy absorption as required in structural behaviour of few material.

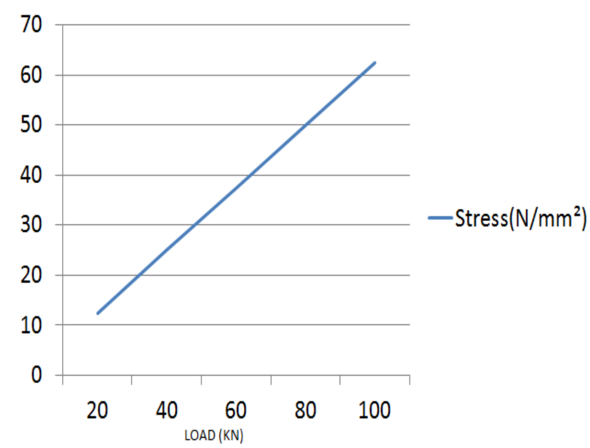


Chart-3: Bending Test

Hardness properties:

An good surface of bonding between filler and matrix composite offer better mechanical property in case hardness of behaviour. Bonding in implementation of adhesion in great surface hardner. The improvement of crystallization in composite properties in great deal with tensile strength and modules of increase in crystallization.

Final composition material undergoes the fabrication and testing methods as below:

- Flexural Test
- Tensile Test
- Impact Test
- Bending Test.

6. CONCLUSION

A lot of research has been done on natural fibre composite is very high rate. This composite have a mechanical behaviour of fiber based epoxy composites indicates to the many conclusions:

- The fabrication of banana fiber based epoxy composites with varying composition is possible by hand lay-up process.
- From the current experiments results, it has been observed that fiber ratio has major effect on the mechanical properties of the composites like as hardness, tensile strength, flexural strength and impact strength.
- It has been observed that the better mechanical properties found for composites having fiber at 35%.

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