

# Investigation on Mechanical Properties of Bamboo – ash Silicon Carbide reinforced Hybrid Composites

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**Abstract** - This paper describes in detail about the studies of mechanical properties of Bamboo-ash silicon carbide reinforced hybrid composites. Silicon carbide is a significant transition metal. Its carbide exhibits some superior comprehensive characteristics. Silicon carbide is an extremely hard metal. Natural fibers are naturally occurring fibers that are produced by plants, animals, or geological process. Simple natural fibers have low strength and stiffness. The mechanical properties of the hybrid composite of bamboo-ash and silicon carbide varies depending upon the type of natural fiber used. Thus, the hybrid composite can be used in various fields depending upon the strength.

**Key Words:** Hybrid Composites, Epoxy Resin, Silicon Carbide, Bamboo-Ash, Mechanical properties

## 1. INTRODUCTION

Materials are the reason for improving human creation and expectations for everyday comforts. They give achievements in human advancement. People have been getting to and utilizing materials for a few thousand years. Polymer is first started in 1830s, polymer is any class of regular or engineered substances made out of enormous atoms, macromolecules that are more straightforward synthetic units called monomers. They comprise the premise of such minerals as jewel, quartz and feldspar and such man-made materials as solid, glass, plastic, and rubbers.

Hybrid composite material is a multi-stage mix material of at least two segment materials with various properties and various structures through intensifying cycles, it not just keeps up the fundamental qualities of the first segment, yet additionally shows new character which are not controlled by any of the first parts.

The fundamental justification picking polymer grid composites is because of their expense proficiency and simple creation strategies and furthermore the support of hybrid composites has high strength, high effect opposition, low water retention limit, high elasticity, and so forth In this composite material epoxy tar alongside hardener is utilized

and the support material is Silicon Carbide (SiC) alongside Bamboo Ash is utilized.

## 1.1 Objectives

The objective of the polymer which we are developing our own polymer with Silicon carbide and Bamboo-ash with epoxy resin. The polymer which as high strength, high durability and sustain in corrosive resistance. Moreover, hybrid is named as adding natural fibres such as bagasse, megasse, angora, jute, cotton, bamboo ash and in geo fibre. The process is done using simple hand lay-up process.

## 1.2 Hybrid Composite

Hybrid composites are contained an assortment of short or consistent strands bound together by a natural polymer grid. The Hybrid composites is planned with the goal that the mechanical burdens to which the construction is oppressed in assistance are upheld by the support. The limit of the structure is to bond the strands together and to move loads between them. These composites are regularly separated into two classes: built up plastics, and progressed composites. Boss among the upsides of Hybrid is their light weight combined with high firmness and strength along the course of the support. The properties of the hybrid composites rely upon the lattice, and the support materials.

## 1.3 Characteristics of Hybrid composites

- High explicit strength
- High explicit firmness
- High break opposition
- Good, scraped spot opposition.
- Good sway opposition
- Good consumption opposition
- Good exhaustion opposition
- Low cost

### 1.4 Fabrication of Hybrid Composites

There are various methods for the fabrication of polymer matrix composite materials. Some of the methods are Compression molding, Injection molding, Press molding, Hand lay-up process and Spray-up process, Etc. Several curing methods are available. The most basic is simply to allow cure initiated by a catalyst or hardener additive premixed into the resin to occur at room temperature. This polymer composite material is fabricated using Hand lay-up process. Hand lay-up is the most basic method for the fabrication of polymer composites. The process is simple and very cost efficient.

The composite is fabricated by mixing 90% of resin along with hardener as a catalyst and 10% of reinforcement material is mixed in different ratios of Silicon carbide (SiC) along with Bamboo ash is mixed and poured into an open mold and allowed to cure for 8 to 10 hours.

Table - 1: Ratio Test

Samples	Epoxy Resin & Hardener	Reinforcement (SiC)	Fiber (Bamboo-ash)
1	90%	4%	6%
2	90%	3%	7%
3	90%	5%	5%
4	90%	0%	10%



Fig - 1: Reinforced Hybrid Composite (Sample 1)

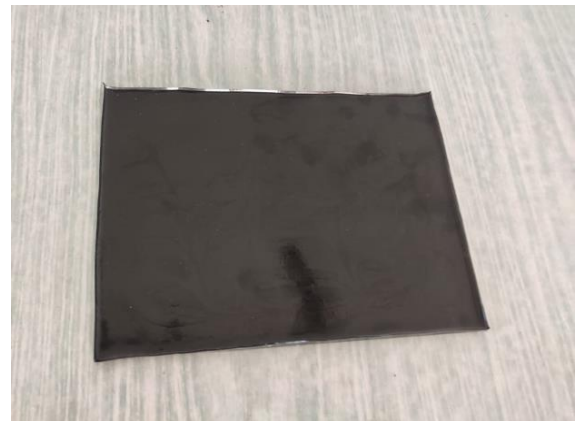


Fig -2: Reinforced Hybrid Composite (Sample 2)



Fig -3: Reinforced Hybrid Composite (Sample 3)



Fig -4 : Reinforced Hybrid composites ( Sample 4)

### 1.4 Applications

- Aerospace structures:** The military airplane industry has primarily driven the utilization of polymer composites. In business carriers, the utilization of composites is continuously expanding. Space transport

and satellite frameworks use graphite/epoxy for some underlying parts.

- **Marine:** Boat bodies, kayaks, kayaks, etc.
- **Automotive:** Body boards, leaf springs, drive shaft, guards, entryways, hustling vehicle bodies, etc.
- **Sports products:** Golf clubs, skis, casting poles, tennis rackets, etc.
- **Biomedical applications:** Medical inserts, muscular gadgets, X-beam tables.
- Scaffolds made of Hybrid composite materials are gaining wide affirmation on account of their lower weight, utilization check, longer life cycle, and limited shudder hurt.
- Electrical Panels, lodging, switchgear, separators, and connectors. Also, some more.
- Bulletproof vests and other covering parts.
- Chemical stockpiling tanks, pressure vessels, funneling, siphon body, valves, etc.

### 1.5 Selection Of Materials

- **Epoxy Resin** – high performance adhesives are used in various structure such as plastics, paints, coatings, primers, and sealers.
- **Hardener** – the hardener which will act as catalyst and reactant for certain chemical reaction. The main naphthalene’s are used for hardener.
- **Carbide** - the carbide is used as reinforcement in the product. The Silicon carbide powder (SiC) is used as reinforcement in this product.
- **Natural Fiber** - the fiber which is taken from naturally prepared and generated as the natural fiber gives strength, stiffness, and good tensile strength. Various natural fiber is available such as Banana fiber, Bagasse, Maize, Egg shell and agriculture waste. The natural fiber used in this polymer is Bamboo-ash .

## 2. MECHANICAL PROPERTIES

Various mechanical tests have been performed on the hybrid composite material reinforced with Silicon carbide carbide along with bamboo ash. The results of the various tests have been shown in the table below.

Table - 2: Impact Test

S. No	Impact Test [J]
Sample 1	0.100
Sample 2	0.115
Sample 3	0.221
Sample 4	0.227

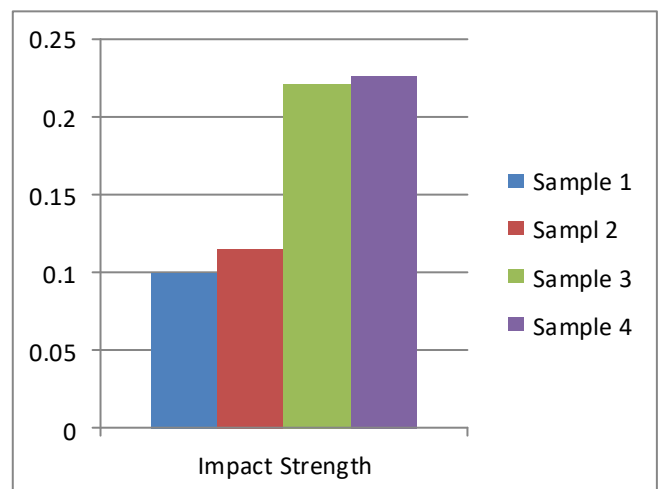


Chart – 1 Impact Strength

Table – 3: Tensile Test ( Stress)

S. No	CS Area [mm <sup>2</sup> ]	Peak Load [N]	%Elongation	UTS [N/mm <sup>2</sup> ]
Sample 1	75.000	1041.685	3.79	13.891
Sample 2	75.000	107.782	2.01	1.432
Sample 3	75.000	781.975	3.16	10.428
Sample 4	75.00	334.266	0.81	4.454

Table – 3: Tensile test ( Load ):

S. No	CS Area [mm <sup>2</sup> ]	Peak Load [N]	%Elongation	UTS [N/mm <sup>2</sup> ]
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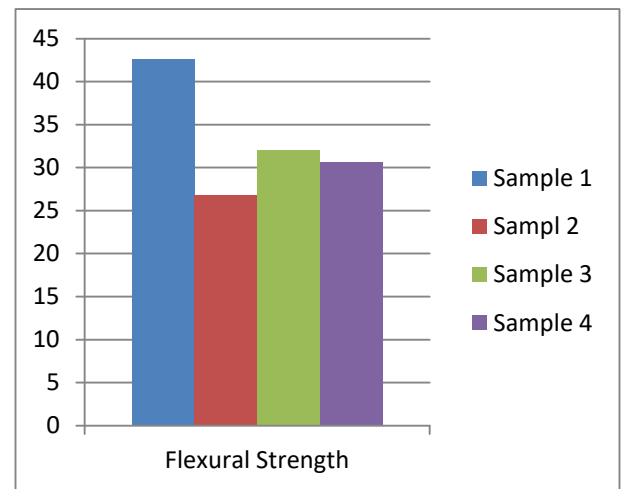


Chart -3 Flexural Strength

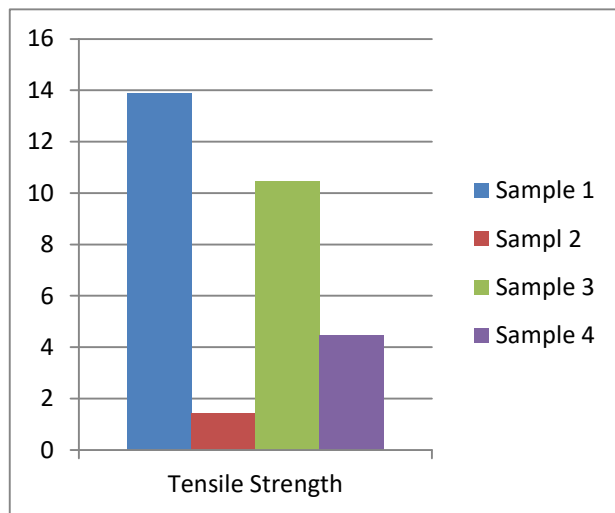


Chart -2 Tensile Strength

Table – 4: Flexural Test

S. No	CS Area [mm <sup>2</sup> ]	Peak Load [N]	Flexural Strength (MPa)	Flexural Modulus (GPa)
Sample 1	39.000	66.522	42.64	2705.04
Sample 2	39.000	41.702	26.73	3136.04
Sample 3	39.000	50.021	32.07	2659.54
Sample 4	39.000	47.745	30.61	2589.21

### 3. CONCLUSION

There are numerous polymers accessible in everyday life except all things considered, we will build up another polymer utilizing "Bamboo Ash" and we anticipate that it might be utilized to for any required regions in future. Since the support utilized is Silicon carbide the polymer shows high strength, and the adaptability of the polymer is diminished and furthermore since just fired material is utilized the water assimilation of the composites is decreased extraordinarily. In view of the mechanical test aftereffects of the polymer composite there are different enterprises like vehicle, airplane, guard industry, and so on this particular polymer can be utilized. The expense of assembling this polymer is additionally low and this composite is likewise harmless to the ecosystem contrasted for certain composites.

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