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Research paper



The effect of thermal cycling on the mechanical properties of jute fiber reinforced by E-glass fiber composites

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Abstract

This work researches the mechanical, aging and opacity properties of jute fiber reinforced by E-glass fiber by hybrid composites. The detrimental impacts of climate conditions are reproduced and they are used to anticipate the longevity of materials utilized outside. Rain and humidity are additionally be reenacted with a buildup framework and additionally water splash. The harming impacts of daylight are reproduced by UV-fluorescent lights. UVB light ranges from 280-315 nm are conveyed to uncover in hybrid composite and varieties in tensile tests are resolved for 50, 75 and 100 hrs. The mechanical properties as an element of fortification substance are influenced which are reflected in the estimations of the ductile modulus and quality and also affect protection and hardness. Including mechanical properties, opacity test is conducted before and after exposure to ultraviolet radiation and surface morphology is studied

Keywords: *E-glass, Jute fiber, UVB lamp, opacity test, SEM.*

1. Introduction

The material composition including type of organic matrix could be more relevant to roughness maintenance over time than the general behavior of composites based on particle fillers. Moreover, this study revealed that correlations between micro hardness (HV) and surface of roughness were poor. Elastic moduli and tensile strength of FRP rebar's made from glass and aramid fibers were subjected to cyclic thermal actions at temperatures ranging between 20 and 70°C, typical of natural hot-climate environments. r radiation, and aggressive chemical agents that occur during their service life. The degrading effect of environmental actions on the mechanical properties of FRPs reduces the durability of concrete structures. As a consequence, for an efficient use of FRPs as substitutes for traditional steel reinforcements in reinforced concrete structures, an analysis of the durability of FRP materials considering all possible deteriorating conditions is necessary. Actually, a large amount of experimental results on the durability predictions for FRP materials is available and several guidelines for durability testing are reported in the Codes.

2. Materials used:

The material is Jute fiber reinforced by E-glass fiber composite. The materials are purchased from Ram composites Pvt. Ltd, Hyderabad. Jute/E-glass composites were prepared in square shape samples of size 25mmx25mmx3mm by the conventional hand layup process.

3. Experimentation:

The investigations were carried out with Jute/E-glass composites. The composites used for the present investigations were prepared by the Conventional Hand layup process of various shapes. The samples were placed under thermal chamber in which the temperature is maintained from -200 to + 550c @ of 50c per minute for five cycles. Specimens were then removed from the chamber and tested for their mechanical properties. After that the specimens were subjected to microstructural characterizations.

3.1. Weight loss/ gains:

Samples were removed from the test chamber after -100c, 150c, 300c, 400c and 550c, which were kept at in temperature chamber, in order to evaluate the weight changes under each exposure condition.

3.2. Tensile Tests:

Square shaped specimens 25mm x 25mm x 3mm were tested in tension and the data obtained was analyzed for determining the properties.

3.3. Surface hardness:

The specimens are tested for their surface hardness under Rockwell hardness tester.

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3.4. Surface morphology:

The retrogression in mechanical properties related to different conditions had been characterized using scanning electron microscopy (SEM).

4. Results

4.1. Weight loss/ gains:

The samples kept in chamber are taken out at-100c, 150c, 300c, 400c and 550c successively and the weight changes are recorded in Table 1 and graphs are shown in Figure 1.

Table 1: Experimental results for weight changes

S.No	Initial weight(grams)	Varying temperatures(^{0}C)	Final weight(grams)
1	25	-10	24.8
2	25	15	24.4
3	25	30	24.3
4	25	40	24
5	25	55	23.8

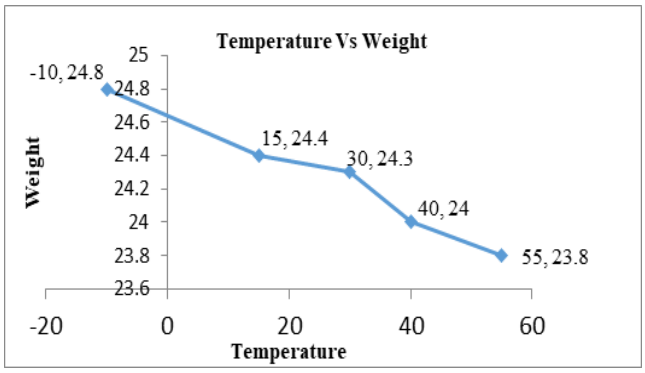

Figure 1: Graph showing Temperature VS Weight

4.2. Tensile Tests:

The specimens have been exposed to thermal cycling are subjected for tensile tests and the data have been compiled in table 2.

Table.2: Experimental results for exposure of specimens at different temperatures and tensile strength

S.No	Initial Tensile Strength(MPa)	Varying temperatures(^{0}C)	Final weight(grams)
1	80	-10	77
2	80	15	75
3	80	30	60.2
4	80	40	67.3
5	80	55	58.9

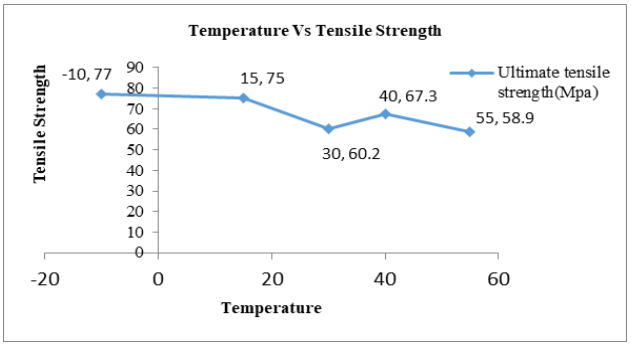

Figure 2: Graph showing Temperature VS Tensile strength

4.3. Surface hardness:

The thermal cycled specimens have been subjected to hardness test and the data have been compiled in table 3 and Graphs are shown in Figure 3.

Table.3: Experimental results for exposure of specimens at different temperatures and their surface hardness.

S.No	Initial Surface Hardness	Varying temperatures(^{0}C)	Final Surface Hardness
1	80	-10	82
2	80	15	80.3
3	80	30	80
4	80	40	79.6
5	80	55	75

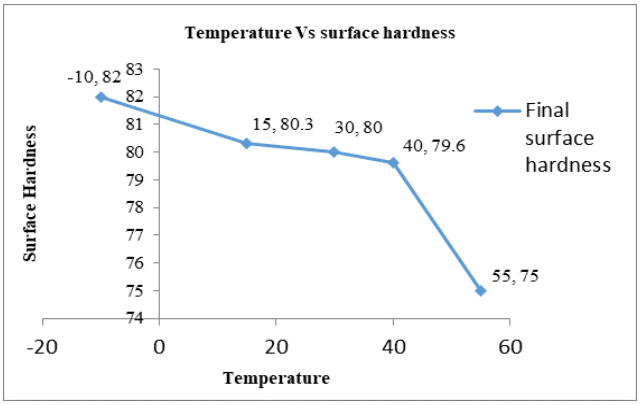

Figure 3: Graph showing Temperature VS Surface hardness

4.4. Surface Morphology:

The SEM micrographs of the thermal cycled specimens drawn at three different temperatures are given from figure 4 to 6respectively.

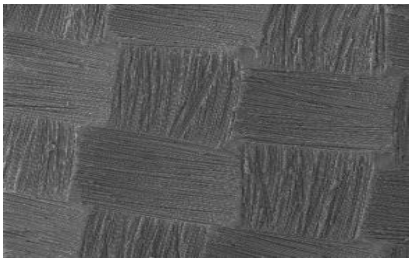

Figure 4: At -10^{0}c

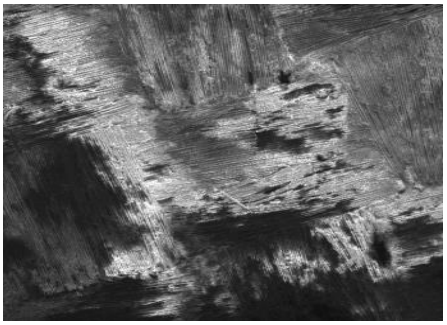

Figure 5: At 40^{0}c

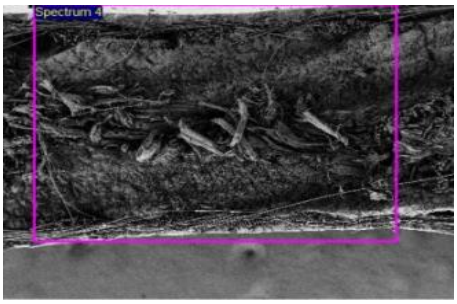

Figure 6: At 55^0c

5. Conclusion

When the specimens are subjected to thermal cycling from -200 to 550c @ 50c/ min at 5 cycles, the following conclusions are withdrawn. They are:

- There is no much variation in loss of weight though there is loss in weight.
- Tensile strength has decreased due to loss binding property between the fibers.
- Initially hardness has increased and with increase in temperature, hardness has decreased due to adsorption/desorption of moisture between fibers.
- When SEM analysis has done, with increase in temperature, due to loss of adhesion, the fibers are cracked and interface cracking has observed.

References

[1] YilmazEC,Sadeler R. Effect of thermal cycling and microhardness on roughness of composite restorative materials. J Res Dent 2016:4:93-6

[2] Environmental Effects on the Mechanical Properties of Glass-FRP and Aramid-FRP Rebars.Mechanics of Composite Materials September 2000, Volume 36, Issue 5, pp 395–398

[3] Thermal cycling effects on the durability of a pultruded GFRP material for off-shore civil engineering structures.panelSotiriosA.Grammatikos[a]RyanG.Jones[b]MarkEvernden[b] [c]JoaoR.Correia[d]

[4] Effects of Thermal Cycling on Thermal Expansion and Mechanical Properties of SiC Fiber-Reinforced Reaction-Bonded Si3N4 Composites by R.T. Bhatt and A.R. Palczer

[5] A. Nanni (ed.), Fiber Reinforced Plastic (FRP) Reinforcement for Concrete Structures, Elsevier (1993)

[6] State-of-the-Art-Report on Fiber Reinforced Plastic (FRP) Reinforcement for Concrete Structures, ACI Committee 440 (1995).

[7] Recommendation for Design and Construction of Concrete Structures Using Continuous Fiber Reinforcing Materials, JSCE (1996)

[8] F. S. Rostasy, "On durability of FRP in aggressive environments," in: Proc. of Int. Symp. on Non-metallic (FRP) Reinforcements for Concrete Structures, Sapporo. Vol. 2 (1997), pp. 107-114

[9] N. Gowripalan and H. M. Mohamed, "Absorption charateristics of aramid fiber reinforced polymer tendons and effects on mechanical properties," in: Proc. Int. Symp. Non-metallic (FRP) Reinforcement for Concrete Structures. Selected Presented Papers, Baltimore (1999), pp. 93-105