

Effect of Mechanical Properties on Jute Fiber Reinforced By E-Glass Fiber When Treated to Change in Environment.

B. Sudhabindu, T. Pavan Kumar, S. Ramakrishna, K. Rajashekhar,

Abstract: Fiber reinforced polymer (FRP) composites are used in various atmospheric conditions, tests are under gone for their various stress concentrations when subjected to different atmospheric conditions related to their thermal expansions. The present work aims to study the change in effects when they were subjected to hygrothermal conditioning cycles like change in temperature keeping humidity as constant and change in humidity keeping temperature as constant on Jute/ E-glass composites. Observations on tensile tests, hardness and absorption/desorption were noticed to be dependent on the nature of hygrothermal effects and SEM analysis was conducted on the specimens.

KeyWords: Temperature, Relative humidity, Tensile strength, Hardness, Elongation, SEM

I. INTRODUCTION:

A lot of research has been centered around endeavoring to survey the connection between interfacial structure and properties of fiber-network composites. It is at the interfacial zone where stress fixation creates as a result of contrasts in the warm extension coefficients between the fortification and the network stage. A huge confuse in the earth incited debasement of network and fiber prompts the advancement of restricted anxiety fields in the FRP composites. When the specimens are subjected to hygrothermal effects i.e when subjected to moisture upto 120 hours, the specimens gain their weight by 7% . But the weight reduction when subjected to hot and wet conditions is low due to loss of adhesion between the fibers¹. When the specimens were treated to thermal cycling from 20⁰c to 60⁰c @ 5⁰c/min, hardness was increased initially with the change in temperature after wards it decreases due to loss of binding property². When morphology studies are conducted on Electrospun Polymer Composites at humidity conditions, diameter size distributions were observed and difference in humidity impact was dependent on polymer nature³.

1. Experimentation: Experimentations were taken with Jute/E-glass composites. They were prepared by hand layup process. Change in environment was done based upon the changes in between the relative humidity and temperature. Samples were then taken out from the chamber to test the properties. Then the samples were subjected to micro structural entactments.

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B. Sudhabindu, Asst Prof Department of Mechanical Engineering, VJIT.

T. Pavan Kumar, Asst Prof Department of Mechanical Engineering, VJIT.

S. Ramakrishna, Asst Prof Department of Mechanical Engineering, VJIT.

K. Rajashekhar, Asst Prof Department of Mechanical Engineering, VJIT.

2. Results: Here the mechanical properties were conducted on specimens when samples are subjected to change in relative humidity and temperature.

2.1. Tensile Tests: These are conducted in two different conditions. They are

i) When temperature is varied form 20⁰c- 60⁰c at 3⁰c/min keeping humidity at 95RH, The following are the results:

Table 1. Tensile strength and Elongation when temperature varies from form 20⁰c- 60⁰c at 95RH

S.no	properties	Tensile Strength (MPa)	% of Elongation	Hardness
1	20 ⁰ c	35.5	4.7	84
2	30 ⁰ c	35.7	4.2	83.1
3	40 ⁰ c	35.8	4.9	82.8
4	50 ⁰ c	35.9	4.8	81.9
5	60 ⁰ c	35.4	4.7	81.2

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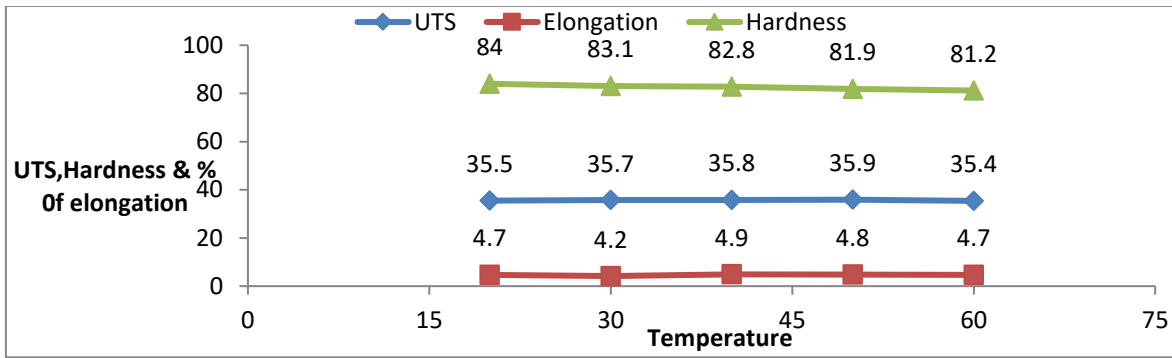


Figure 1: Graph showing Ultimate Tensile strength, Elongation and hardness when temperature varies from 20°C- 60°C at 95RH

i) When humidity varies from 65 – 95RH at 3RH/min keeping temperature at 35°C, The following are the results:

Table 2. Tensile strength and Elongation when humidity varies from 65 – 95RH at 35°C

S.no	Properties	Tensile Strength (MPa)	% of Elongation	Hardness
1	65RH	38.4	5.6	84
2	75RH	38.9	5.1	83.5
3	82RH	38.5	5.8	83.0
4	90RH	38.3	5.5	82.5
5	95RH	38.2	5.2	81.9

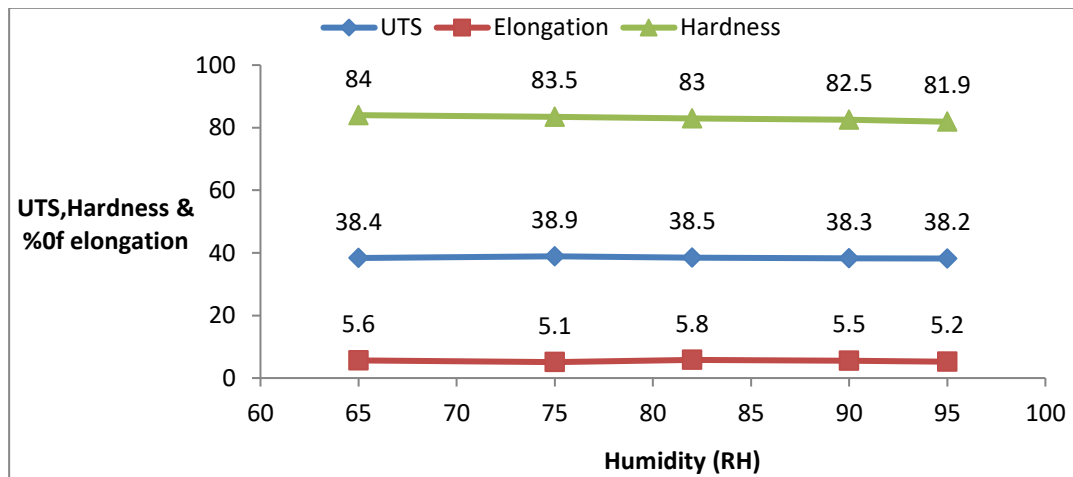


Figure 2: Graph showing Tensile strength , Elongation and hardness when humidity varies from 65 – 95RH at 35°C.

a. Surface Morphology: SEM analysis are conducted to study the absorption/desorption of the specimens. Jute woven surface is shown on the surface in figure 3. When sides of the specimen are read, a matrix of jute reinforced E-glass fibers can be seen in figure 4. When the specimens are subjected to vary in temperatures at constant humidity of 95RH, the fibers are disassociated from each other and are deviated from the matrix was shown in figure 5 when specimens are read at their sides. Similarly when specimens are subjected to change in humidity at constant temperature of 35°C, loss of adhesion was occurred. Due to this the binding property was lost between the fibers and deviated matrix can be shown in figure 6. When surface is observed, after subjected to temperature and humidity, there occurs loss of binding property, which results in absorption of moisture leads to expansion of fibers in jute and can be shown in figure 7.

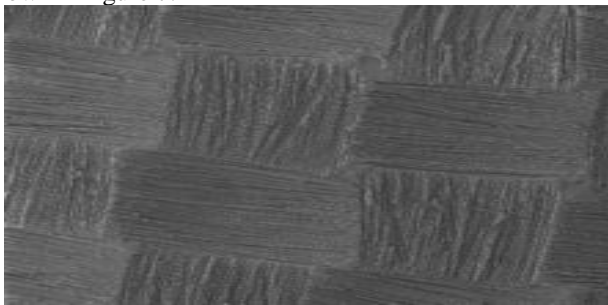


Figure.3 Surface of the specimen



Figure 4: side of specimen

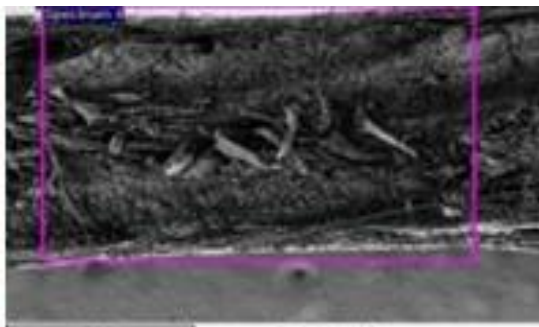


Figure 5. Loss of adhesion

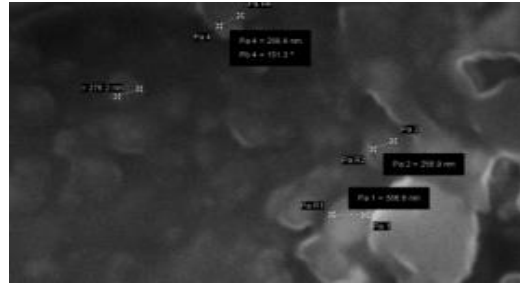


Figure 6. Loss of binders

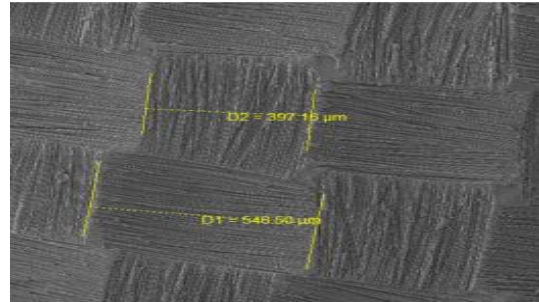


Figure 7. Expansion of Fibers

II. CONCLUSIONS:

Tensile tests and % of elongation is good in variation of relative humidity keeping temperature constant due to hydrostatic forces which gives better interfacial bond between the fiber and network. Shore hardness is good in relative humidity. On observing the surface of the specimens when subjected to SEM analysis after the specimens are exposed to vary in humidity and temperature, the radius of the fibers increased to 10%.

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