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# A Novel Work on the Thermal Behaviour of Natural Fiber Reinforced Epoxy Composites

**C. M. Meenakshi, Sucharitha S, Ravi D**

***Abstract*: *The need for bio degradable material in all the fields including automobile and mechanical field is growing due to the awareness and polution and enviromenat safety norms. To satisfy this need needs, alternative natural product with similar kind of properties has to be identify . Where these natural products attribute can be enhanced using some processing techniques and by adding suitable chemicals. Composite materials are the one which is ruling our world and the need for them is marginally high and we need to find new enhanced matrices which have much more good qualities than the old one and find the alternate for them in their existence. The hybrid composite manufacturing has been wide range of investigations. The composites have superior properties like light weight, low density, stiffness, and better mechanical properties. The present work aims on mechanical and thermal behaviours of GKG, GAG, and KGA fibre reinforced epoxy composites. Hand layup method used for fabricate hybrid composite laminates. The thermogravimetric analysis, heat distortion temperature test are carried out to find its thermal stability. For testing and analysis, the specimens are cut as per ASTM standards.***

***Keyword* : *Composite materials, Hypothermal Exposure***

## I. INTRODUCTION

Composites become the most sorted material due to its leight weight and strength also providing design flexibility because many of them can be molded into complex shapes. Natural fibre reinforced composites found applications in both engineering and service sectors. Polymer composite materials frequently have mechanical and physical properties that improve them appropriate for a wide scope of uses than the individual composite segments[1],[3],[5]. The utilization of normal fiber improvement of polymeric materials that are created from supportable and naturally composites ordinarily have a fiber or molecule stage that is stiffer and more grounded than the persistent lattice stage and serve "composites are multifunctional material frameworks that give qualities not reachable from any discrete material. The NFC separated flax FIBERs have been found to have quality 20% higher than those removed precisely. The Fabrication Reinforced Composites (FRC) is expanding quickly in the car, aviation and wind vitality parts in view of their high explicit quality and modulus. This task work went for the uses of Natural plant strands, for example, flax, sisal and delivering a characteristic based material composite overlay produced using sustainable agrarian and ranger service feedstock. The characteristic fiber utilized will be synthetically treated to improves its exhibition and the overlay will be set up with this treated strands. At that point it will be exposed to mechanical portrayal and broke down[2],[4],[6].

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## II. RELATED WORKS

In 2013, N. Abilash, M. Sivapragash considered on advancing the delamination disappointment in bamboo fiber fortified polyester composite. They examined on bamboo fiber strengthened with polyester in pressure shaping strategy. They directed dim worth test on the composite. They presumed that by diminishing the feed rate and drill distance across delamination impact can be limited that prompts better quality openings.

In 2013, M. Ramesh, K. Palanikumar, K. Hemachandra Reddy contemplated on the near assessment on properties of cross breed glass fiber-sisal/jute fortified epoxy composites. They directed pliable and flexural test on the composite. They finished up that performance of normal fiber composites is lower than that of GFRP. Sisal-GFRP composite perform better in ductile stacking and jute-GFRP composites better in flexural stacking.

In 2014, A. BelaadIa, A. Bezazi, M. Maache, F. Scarpa examined on weakness in sisal fiber fortified polyester composites: hysteresis and vitality scattering. The investigation was about sisal fiber strengthened polyester composite[7],[9],[11]. The tests led on the fiber are pliable test, weariness test, static test. They presumed that the examination of sisal polyester bio composites exposed to 3point bowing under static stacking demonstrates that hysteresis circle and disseminated vitality per unit volume as an element of cycle number is profoundly reliant on stacking level on the example.

## III. SAMPLES FOR MECHANICAL CHARACTERIZATION

Composite laminates prepared are cut into smaller samples of ASTM standards, for various test procedure and the sized specimens are shown in the forthcoming figures[19],[21],[22].

### A. Heat Deflection Temperature

The warmth mutilation (or warmth diversion) temperature (HDT) is a significant property of polymers. It gives a sign at what temperature materials begin to "relax" when presented to a fixed burden at raised temperatures.

The HDT is characterized by ASTM D 648 as the temperature at which an example bar of standard measurements (120x 10 x 4 mm) avoids by 0.25 mm (0.01 in) less than a focused standard flexural heap of 9 MPa. The example is warmed in a submersion shower at a pace of 2oC/min.

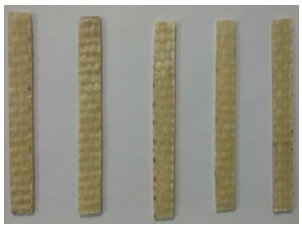


Figure 1- Tensile test Specimen

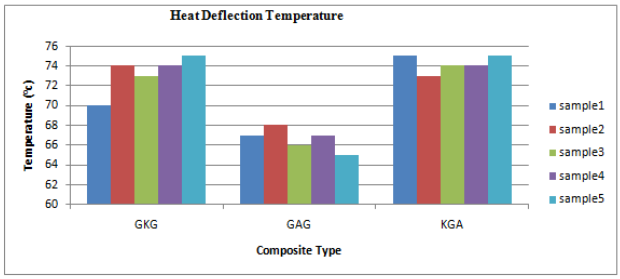
### B. Thermogravimetric Analysis

Thermogravimetric examination (TGA) is a technique used to locate the material's warm dependability aby checking the weight change that happens as an example is warmed at a consistent rate[8],[10],[12]. The test is generally completed in air or in a latent environment, for example, nitrogen or argon, and the weight is recorded as an element of expanding temperature. There are a few reports on the interfacial portrayal of characteristic fiber fortified polymer composites utilizing thermo gravimetric investigation (TGA).

## IV. RESULT AND DISCUSSION

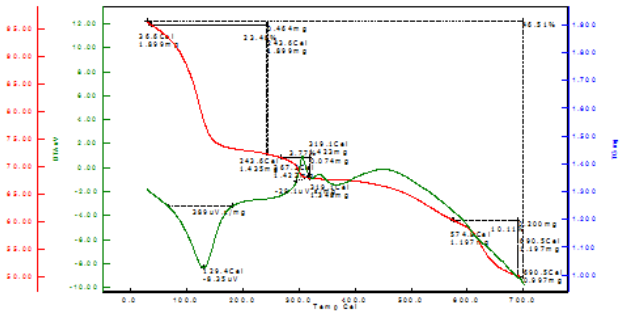
### A. Heat Deflection Test

| Sample | Heat deflection temperature (°C) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | Average |
| GKG | 70 | 74 | 73 | 74 | 75 | 73.2 |
| GAG | 67 | 68 | 66 | 67 | 65 | 66.6 |
| KGA | 75 | 73 | 74 | 74 | 75 | 74.2 |

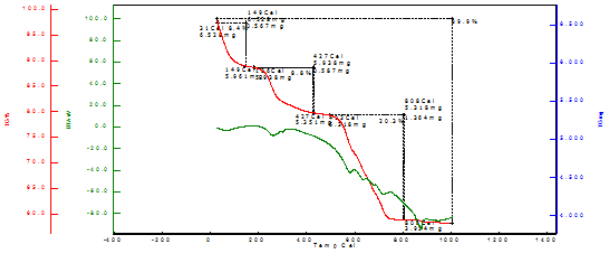



### B. Thermogravimetric Analysis

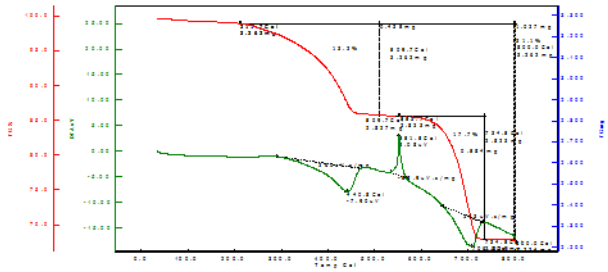
From the graph we understood that the GKG sudden degradation starting in 319.1 Celsius. The degradation temperature goes on till 690.5 Celsius[13],[15],[17]. The results are shown in graph in figure 4.



From the graph we understood that the GAG sudden degradation starting in 427 Celsius. The degradation temperature goes on till 808 Celsius. The results are shown in graph in figure 5



From the graph we understood that the KGA sudden degradation starting in 509.7 Celsius. The degradation temperature goes on till 690.5 Celsius. The results are shown in graph in figure 6.



| Composite type | Tensile Strength N/mm² | | | |
|---|---|---|---|---|
| | Sample 1 | Sample 2 | Sample 3 | Average |
| GKG | 68.97 | 70.37 | 63.62 | 67.65 |
| GAG | 69.86 | 63.95 | 58.92 | 64.24 |
| KGA | 29.88 | 32.08 | 28.89 | 30.28 |

### C. Comparison of Thermogravimetric Result

The thermogravimetric analysis result shows that the hybrid composite is showing equally good performance to glass fiber reinforced composite and natural fiber reinforced composite is also showing positive result[14],[16],[18]. From the table we understood that the KGA degradation temperature is higher when compared to GKG and GAG. The less degradation temperature obtained by GKG when compare to GAG and KGA. The results are shown in below table.

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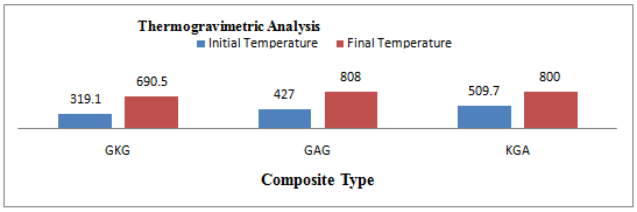
| Composite type | Thermogravimetric Analysis Temperature (Celsius) | |
|---|---|---|
| | Initial Degradation Temperature | Complete Degradation Temperature |
| GKG | 319.1 | 690.5 |
| GAG | 427 | 808 |
| KGA | 509.7 | 800 |




## V. CONCLUSION

Three types of composite laminates are fabricated using hand layup method with Glass, Kenaf and Aloe vera fibers in Epoxy Resins and their mechanical and thermal properties are studied. From the results the following conclusions are made.

- From heat deflection temperature test, it is understood that KGA and GKG are having the high temperature withstanding capacity.
- From thermogravimetric analysis, KGA had maximum degradation temperature.

The overall results shows, the hybridization of natural fiber along with the glass fiber has good impact on the thermal capacity of the composites. Also we found that, if the proportion of natural fibre increased then the thermal ability will be increased.

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