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A STUDY ON KEVLAR / GLASS FIBER LAMINATES WITH NANOCLAY ENHANCED EPOXY MATRIX

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ABSTRACT

In recent years, the industries are focusing their attention towards the development of sustainable composites. Researchers are working on fabrication of new composite materials to enhance the applicability of these materials. Particularly in polymer composites, laminated composites are most interesting for their properties. In view of this, the new polymer hybrid composite is developed in which the glass and Kevlar fiber is reinforced to the epoxy resin with the application of nano clay. Composite laminate with varying the number of layers of Glass fiber and Kevlar fiber and modified epoxy with 2 % of Cloisite 30B and hardener are used and strips are fabricated and tested for their mechanical properties. Epoxy and hardener is taken in the ratio of 10:1 for this study.

KEY WORDS: Kevlar, fiber, nano clay, epoxy, matrix.

I. INTRODUCTION

Composite materials assume an indispensable function in numerous modern applications. Researchers are chipping away at manufacture of new composite materials worldwide to upgrade the appropriateness of these materials. Fiber Reinforced Polymer (FRP) is a composite material made of a polymer matrix fortified with fibers. The most broadly utilized engineered fibers till date are glass, carbon, aramid and Kevlar. Over the ongoing years, FRP composites have gotten progressively main stream for its auxiliary applications in aviation, marine, vehicle and development businesses because of their higher mechanical presentation. BhanuPratap, H C Chittappa has accomplished work on manufacture of the nano clay filled bidirectional glass Kevlar strengthened epoxy hybrid composite that is gotten by straightforward hand layup procedure for various extents. It is demonstrated that when nano clay is augmented in little percent, the flexural quality is incredibly affected by the diverse fiber extents. The best possible transmission and dispersion of the applied pressure by the epoxy gum brings about higher quality of the hybrid composite. The flexural

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properties of the nano clay filled bidirectional jute Kevlar fortified epoxy hybrid composite has the most elevated quality at 3 wt% which is because of the solid holding of the filler with the matrix and fortification and the heap conveyed by them. In this investigation it is seen that the thickness of the composite improves the flexural quality due the expansion of Kevlar which is needed for the dynamic stacking applications. De Rosa et al inferred that utilizing the basalt fiber at the top and lower part of the glass cover improves the post-flexural quality of the hybrid composite. In any case, it discovers hard to come to the end result from one hybrid to the next, as there is no hypothetical structure accessible to survey the different material boundaries. The flexure quality of the glass fiber fortified polymer composite can be improved by consolidating it with E Glass epoxy overlays and making it hybrid polymer composite. Less exploration has been directed in the field of engineered fiber and normal fiber fortified composite material. Nano-particles are right now considered as high-potential filler materials for the improvement of mechanical and actual properties of polymer matrix composites. The benefit of the nano scaled particles contrasted with the miniature scaled fillers is their huge surface region, which can go about as interface for stress-move. Nonetheless, a high SSA causes the development of agglomerates. The agglomerates of the nano-composite are hard to isolate and to invade with the matrix. Impact of expansion of nano clay on the fiber/matrix attachment in epoxy/glass composites was researched. In this investigation, diverse naturally changed clay were added at various weight divisions in the epoxy matrix. The outcomes portrayed that the development of intercalated microstructures due to nano clay prompted significant improvement in mechanical and warm properties of the epoxy matrix. I have discovered an extension to do the venture on polymer strengthened hybrid composites i.e., the blend of Kevlar utilizing nano clay as filler material. Along these lines, my goal is to contemplate the Effect of nano clay on the mechanical properties of Epoxy strengthened Kevlar composites.

II. GLASS FIBER

Glass fibers are among the most adaptable mechanical materials known today. They are promptly created from crude materials, which are accessible in for all intents and purposes boundless gracefully. All glass fibers portrayed in this article are gotten from organizations containing silica. They show valuable mass properties, for example, hardness, straightforwardness, protection from substance assault, steadiness, and dormancy, just as alluring fiber properties, for example, quality,

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adaptability, and solidness. Glass fibers are utilized in the assembling of basic composites, printed circuit sheets and a wide scope of specific reason items. Glass fiber is framed when dainty strands of silica-based or other plan glass are expelled into numerous fibers with little distances across reasonable for material preparing. The strategy of warming and bringing glass into fine fibers has been known for centuries; nonetheless, the utilization of these fibers for material applications is later. Until this time, all glass fiber had been produced as staple (that is, bunches of short lengths of fiber). The premise of material evaluation glass fibers is silica, SiO2. In its unadulterated structure it exists as a polymer, (SiO2)n. It has no obvious liquefying point except for mollifies to 1200 °C, where it begins to corrupt. At 1713 °C, a large portion of the particles can move about uninhibitedly.

General-purpose glass fibers: (E-glass variations) , which gives a top to bottom conversation of creations, dissolve properties, fiber properties, strategies for fabricate, and huge item Glass fibers and textures are utilized in consistently expanding assortments for a wide scope of utilizations that covers all economically accessible E-glass fibers, regardless of whether utilized for fortification, filtration, protection, or different applications. It records all makers, their business workplaces, specialists, auxiliaries, and offshoots, complete with addresses, and phone and fax numbers. What's more, it classifies key properties and applicable gracefully subtleties of all E-glass fiber reviews, that are accessible in the market today.

Special-Purpose Glass Fibers: S-Glass, D-Glass, A-Glass, ECR-Glass, ultrapure silica fibers, empty fibers, and trilobal fibers are unique reason glass fibers. Chosen specific reason glass fibers are talked about in the ensuing part of this article. That segment audits sytheses, production, properties, and applications to a degree proportionate with their business utilize A partner information book is accessible that covers all monetarily accessible high quality glass fibers including S-glass and, all silica or quartz glass fibers, including Astroquartz and Quartzel. It likewise records a wide scope of woven textures that are monetarily accessible in the market of today, going from S-glass/aramid, Sglass/carbon, silica/aramid, and silica/carbon yarns to silica/boron yarns. Likewise, it covers all monetarily accessible carbon, earthenware, boron, and high-temperature polymer fibers and yarns. This information book likewise records all yarn checks, texture developments, texture loads, and business sources.

III. EXPERIMENTAL PROCEDURE

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Composite laminate with shifting the quantity of layers of Glass fiber and Kevlar fiber and changed epoxy with 2 % of Cloisite 30B and hardener are utilized and strips are manufactured and tried for their mechanical properties. Epoxy and hardener is taken in the proportion of 10:1 for this examination. Epoxy is taken in the double headed flask and warmed up to 65-70○C until Epoxy changed to fluid state. In a different recepticle add 2 % of nanoclay and afterward CH3)2CO and blended completely, this combination is added to the epoxy in the double headed flask. The double headed flask is then positioned in the warmer and the mechanical stirrer is kept inside the double headed flask. Blending is proceeded until the absolute weight decreased to net load of Epoxy and nanoclay (45% of weight proportion to the fiber). After weight decrease the container is kept in the Sonicator for 30 minutes. The substance in the measuring utencil is cooled to 30○C and afterward 10% weight proportion of hardener is added and blended for 2 minutes. Sheets were set up by fluctuating layers of glass fiber and Kevlar fiber, the hybrid epoxy alongside hardener kept in the container is utilized as matrix. Additionally sheets with 14 layers of Glass without and with nanoclay were likewise created and in like manner sheets with 14 layers of Kevlar without and with nanoclay were likewise manufactured. The sheets are dried and sliced by ASTM norms and tried. The sheets are cut for ASTM guidelines in shifts ° / + 60°, -60° / -30°, + 30° / +45°, -45° / 90° stacking tendency of 0 All the examples were tried for different mechanical tests and Thermal test outcomes were summed up. The tests consequences of composite laminates with changing layers of glass and Kevlar, Glass fiber laminates with and without nanoclay and Kevlar fiber laminates with and without nanoclay were analyzed and results were read for their mechanical conduct

IV. RESULTS AND DISCUSSION

The Tensile Strength

The mechanical properties of composites depend on the different components, for instance, fiber stacking, fiber length, sort of fiber, direction of fiber, etc. The elasticity of a material is the most outrageous proportion of malleable pressure that it can take before disappointment, for example breaking. As shown by ASTM D-3039 principles for setting up the elastic test models, the malleable trial of composites is finished by using PC controlled Universal Testing Machine (UTM). A pile was related with the two sides of composite examples for the testing. As shown by ASTM D790, the flexural test was directed on the composite examples, which is a 3 point twisting test. The assortment of the mean pinnacle load over the all examples attempted is

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showed up in Figure 1. The pattern top burden conveying limit diminishes with increment in Cloisite 30B rate in the composite.

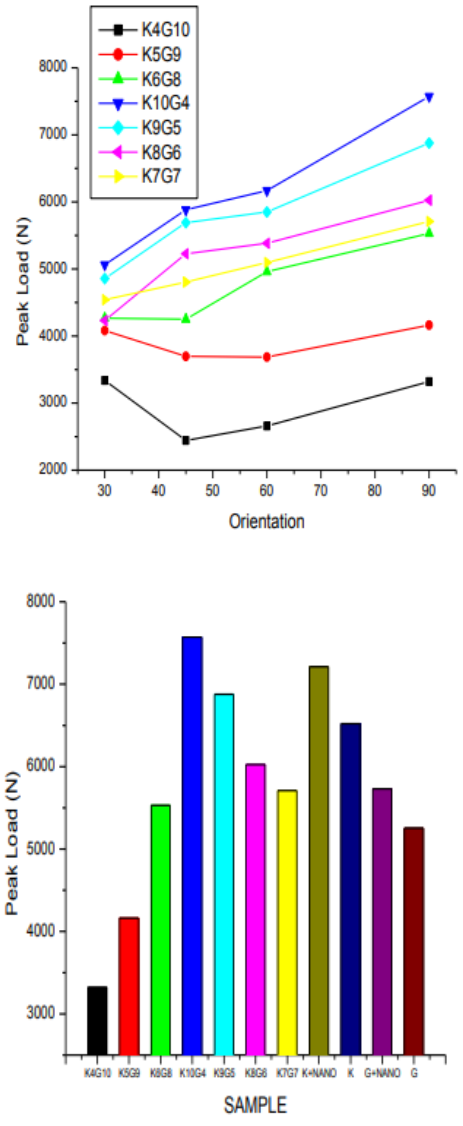

Figure 1 Tensile strength Vs. Orientation for various samples

Compression Test

The compression example is set up as indicated by the ASTM D3410 standard. A compression test remembers mounting the example for a machine and exposing it to the compression. The compression technique incorporates setting the test in the testing machine and applying pack to

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it until it breaks. In the midst of the use of compression, the expansion of the measure fragment is recorded against the applied power. The examples chart produced legitimately from the machine for compression test with regard to load and removal for tests. It is seen that 90 direction gives the most extreme compression load bearing limit. Likewise it is seen that the compression quality is greatest for K10G4 and has an estimation of 101MPa.

The impact test tests are set up as demonstrated by the necessary estimation taking after the ASTM D256 standard. In the midst of the testing methodology, the example must be stacked in the testing machine and allows the pendulum until it breaks or breaks. Using the impact test, the energy expected to break the material can be estimated easily and can be used to evaluate the toughness of the material and the yield strength.

Impact Test

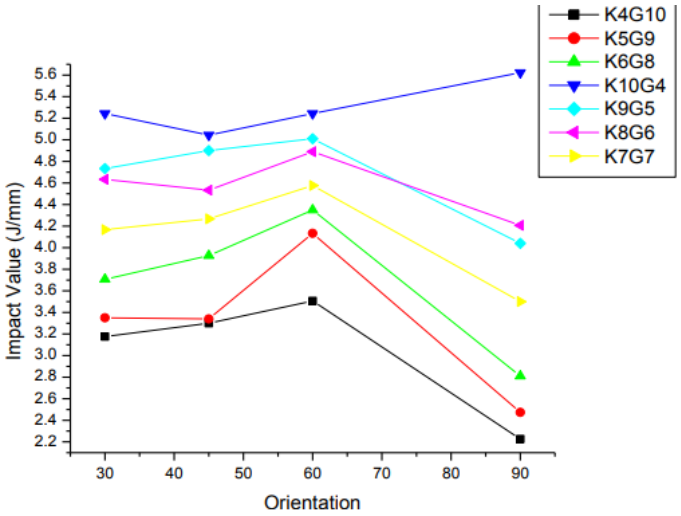

Figure 2: Orientation of All Samples

Flexural Test

The flexural samples are set up as indicated by the ASTM D790 standard. The 3-point flexure test is the most generally perceived flexural test for composite materials. The testing technique incorporates putting the test sample in the all inclusive testing machine and applying power to it until it breaks and breaks. The sample used for leading the flexural test. Figure 5.4 shows the variety in Flexural strength for fluctuating direction. Independent of the quantity of glass or

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Kevlar laminates, flexural strength is discovered to be lower for 30^0 direction and greatest for 90^0orientation. Most extreme flexural strength of 570 Mpa is watched for K10G4 laminates for 90^0 direction.

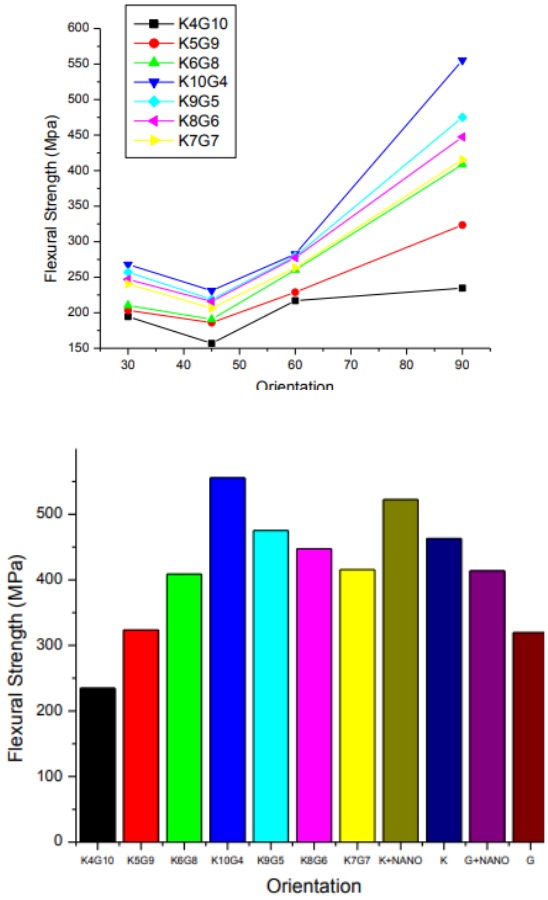

Figure 3 Flexural strength (Mpa) Vs. orientation of all samples

Interlaminar Shear Strength (ILSS)

Inter laminar shear test of the sample is performed to discover the shear strength of the inter laminar layers of Kevlar and glass laminates. Figure 4 shows the short shaft strength of different laminates with fluctuating direction. Greatest inter lamellar shear strength of 64Mpa is found for K10G4 laminates with 90° orientation

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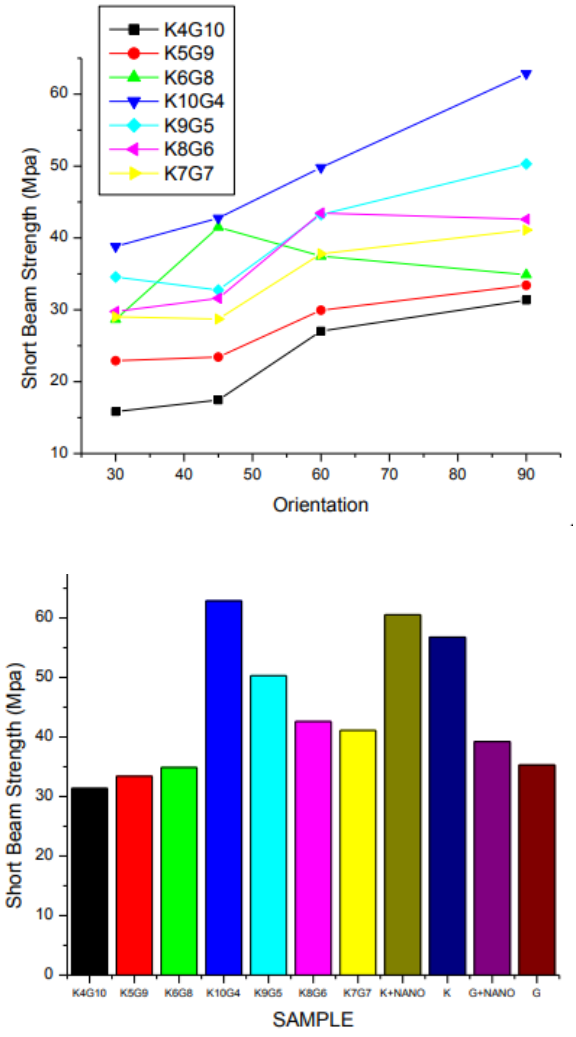

Figure 4 Short beam strength (MPa) Vs. orientation of all samples

V. CONCLUSION

The pinnacle load 16% expansion got for K10G4 composites as contrasted and unadulterated Kevlar, with a relating 15% expansion in compressive strength. Greatest impact estimation of 5.6 J/mm is acquired for K10G4 composites. As the Kevlar layer gets expanded from 0 to 10, 34% expansion in impact esteem is watched. 20% expansion in top load alongside a 20% increment in flexural strength esteem is acquired for K10G4 composites as contrasted and unadulterated Kevlar. 4% decline in level of prolongation is watched for 90degrees direction K10G4 composites when contrasted and unadulterated

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Kevlar. 10% expansion in top load alongside relating 10% increment in short beam strength is watched for K10G4 composites with 90degrees direction as contrasted and unadulterated Kevlar. It is seen that the mechanical properties estimated diminishes, for expanding glass layered laminates. Ideal mechanical properties have been watched for K10G4 layered laminates. The best exhibition in term of impact reaction got for the filled composites was additionally affirmed by the ductile remaining strength which increments with filler content and the distinctions increment with the impact energy.

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