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Mechanical dynamic analysis of banana fiber reinforced polymer matrix composites

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Abstract
Mechanical Dynamic analysis (MDA) could be a powerful technique for the characterization of the elastic properties of polymers. MDA measures the modulus (stiffness) and damping (energy dissipation) properties of materials as they're ill-shapen beneath dynamic stress. These measurements offer quantitative info regarding the performance of materials. this method are often wont to valuate a good style of materials like thermoplastics, composites, thermosets, elastomers, films, fibers, coatings and adhesives. MDA could be a valuable technique thanks to its high inherent sensitivity and is that the most sensitive thermal analysis technique for the measure of the glass transition regions, Tg. Secondary relaxation events without delay discovered by MDA, merely can't be detected by the other thermal technique.
In the gift work, Banana and glass fiber were used because the reinforcement fiber and General Purpose rosin was used because the matrix for fabrication of Natural and Hybrid fiber bolstered composites (FRP's). it's essential to judge the elastic properties of fictitious composites for improved mechanical and thermal properties. The dynamic moduli, mechanical loss and damping behavior as a perform of temperature of the systems were studied victimisation dynamic mechanical analysis (MDA). Within the gift work MDA was administrated on a fictitious Natural and Hybrid FRP's. The fibers thought-about ar Banana & Glass, wherever physician rosin is taken into account as matrix. For MDA analysis fiber a lot of zero.5, 0.7 & 1.0 gram with a gradient are thought-about on each Natural & Hybrid FRP's. The Storage Modulus (E') values are found to be most for composites with one.0 gram fiber loading, indicating that the incorporation of Banana & glass fiber normally Purpose rosin matrix induces reinforcing effects appreciably at higher temperatures. The loss modulus and damping peaks were found to be lowered by the incorporation of fiber. The peak of the damping peaks trusted the fiber content.

Keywords: Mechanical dynamic analysis; banana fiber; composites

1. Introduction
Composites square measure materials shaped from a combination of 2 or a lot of parts to provide a fabric with properties or characteristics superior to those of the individual materials. Most composites square measure shaped of 2 phases: Matrix and Reinforcement. The matrix may be a continuous part material that is sometimes less stiff and weaker than the reinforcement. it's accustomed hold the reinforcement along and distribute the load among the reinforcements. Reinforcements within the style of fibers, fabric, whiskers, or particulates square measure embedded within the matrix to provide the composite. they're discontinuous, sometimes stronger and stiffer than the matrix and supply the first load-carrying capability of the composite.
The use of natural composite materials has been a locality of man's technology since the primary ancient builder used straw to strengthen mud bricks.
The twelfth century Mongols created the advanced weapons of their day with athletics bows that were smaller and a lot of powerful than their rivals. These bows were composite structures created by combining oxen tendons, horn, bamboo, and silk that secure with natural pine rosin. The tendons were placed on the strain facet of the bow, the bamboo was used as a core, and sheets of horn were laminated to the compression facet of the bow. the whole structure was tightly wrapped with silk mistreatment the rosin adhesive. within the late 1800s canoe builders were experimenting with gluing along layers of kraft with shellac to make paper laminates. within the years between 1870 and 1890, a revolution was occurring

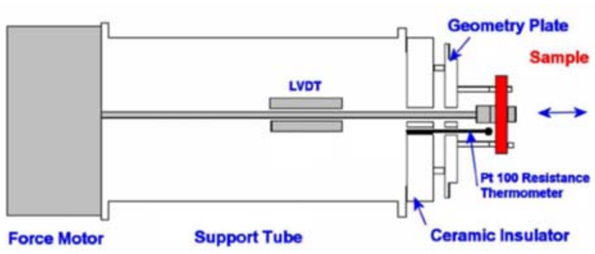

Fig 1: experimental setup for MDA

2. Diamond Mda

PerkinElmer offers the Diamond MDA for progressive dynamic mechanical measurements.
The instrument offers the subsequent valuable options and benefits:

1. Fourier remodel technology for unique sensitivity.
2. Unsurpassed frequency multiplexing operation and artificial Oscillation Mode for additional complete characterization and quicker turnaround times.
3. Application of a large dynamic force vary (up to 18N force) to handle a large vary of samples from single fibers and skinny films to thick, stiff composites.
4. Simplified, easy operation to permit for correct and consistent measurements to be simply performed with negligible operator interaction.
5. Wide frequency vary (0.01 to a hundred Hz).
6. Patented controlled cooling system for unexceeded measurements within the crucial.
7. Sub-ambient regions.
8. Multiple modes of sample deformation (bending, shear, tension, compression) to accommodate the widest vary of samples and applications.
9. Patented advanced machine tension management for the simple analysis of skinny films, fibers and compound plaques.
10. Special sample immersion temperature controlled bathtub and wetness environmental accessories.

Fig 2: Diamond MDA

3.0 Experimental Procedure

Preparation of Die

In this process, we have taken three mild steel pieces with 160mm x120mm x 6mm dimensions, and four rectangular holes with 50mm x 10mm x 6 mm dimensions as shown in fig.3 & 4 were made.

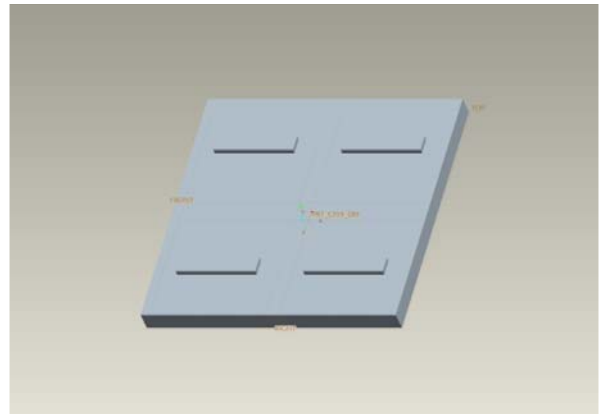

Fig 3: Female Die

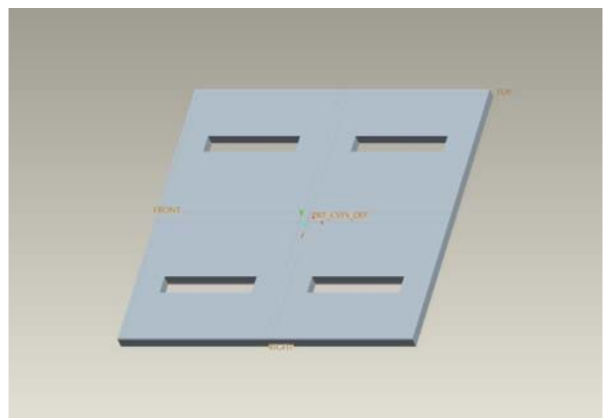

Fig 4: Male Die

Materials

Fibers - Banana fiber, optical fibre
Matrix - General purpose rosin (GPR)
Accelerator - Co naphthenate
Hardener - alkyl radical alkyl organic compound peroxide

Experimental Conditions

Experiments area unit conducted by applying a little cyclic deformation to a sample over a good temperature vary. The subsequent experimental conditions were wont to analyze the compound sample.

Instrument	-	Diamond MDA
Heating rate	-	5 0C/min
Temperature vary	-	120 ^{0}C to one hundred fifty ^{0}C
Frequencies	-	zero.5, 1, 2, 5, and 10 Hz
Maximum load vary	-	up to eighteen N
Deformation mode	-	3 purpose bending
Sample dimensions	-	length (l)-50 millimeter, dimension (w)-10 millimeter, thickness (t)-3 millimeter
Deformation amplitude	-	40 µm
Cooling	-	cryogen with machine-driven Cooling accent

Check Procedure

In this check, the sample is clamped within AN environmental chamber and cooled to -120°C. Frequency, amplitude, and a temperature vary applicable for the fabric area unit input. A little deformation is then applied, and also the ensuing force is measured. once the deformation is complete, the temperature is raised by 5-10°C, and also the deformation is continual. For composites, testing continues up to 150 °C, at which period the composite starts to degrade or soften. Sample MDA knowledge is shown in fig.5 on the graph below

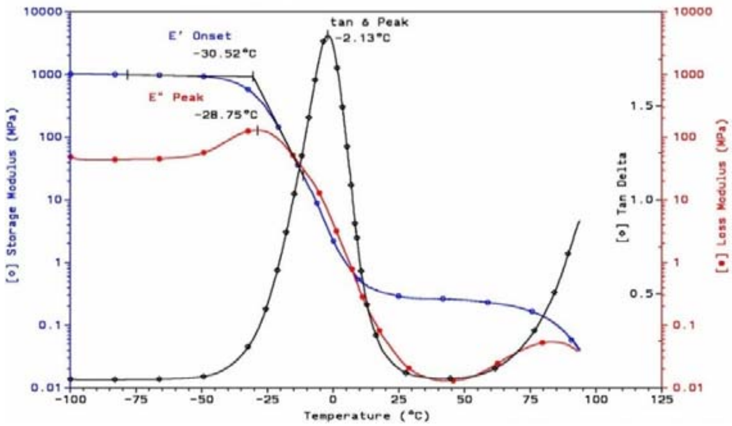

Fig 5: MDA results (E', E" and tan delta) for compound moistening material

From the force response of the sample it's attainable to calculate the modulus (stiffness) and dissipative (tan δ) characteristics of the composites. Typically, experiments area unit conducted by varied temperature at a relentless deformation frequency (1 Hz); different frequencies also can be wont to simulate conditions a lot of like field applications. Experiment will be conducted for 3-point bending.

4. Results and Discussions

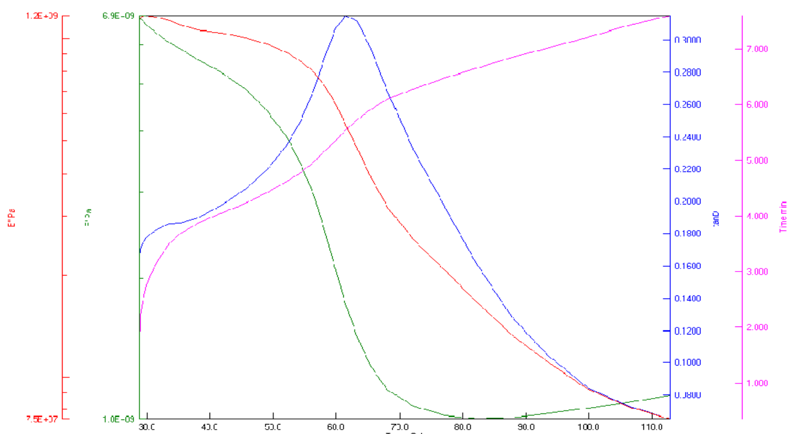

Fig 6: Shows MDA results (E', E" and tan delta) for polymer dampening material (0.5 gr. Banana Fiber)

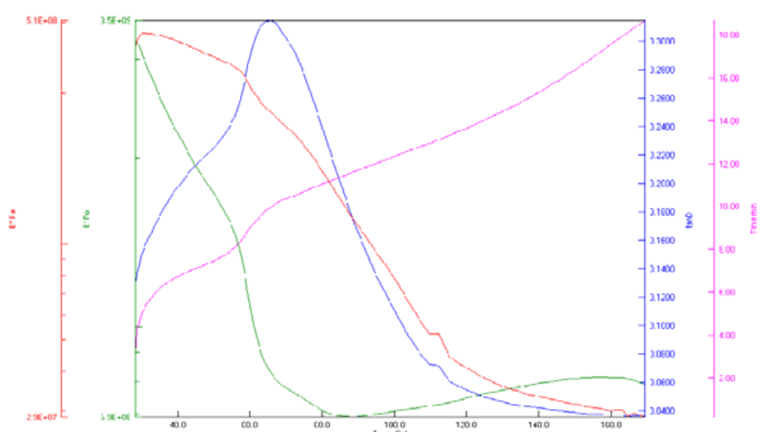

Fig 7: Shows MDA results (E', E" and tan delta) for polymer dampening material (0.7 gr. Banana Fiber)

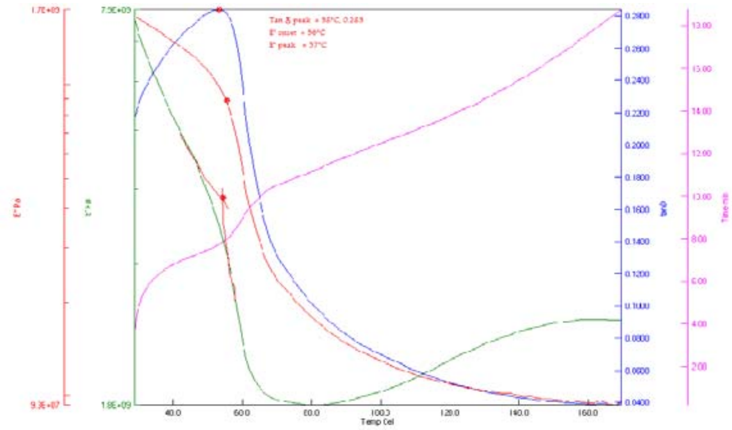

Fig 8: Shows MDA results (E', E" and tan delta) for polymer dampening material (1.0 gr. Banana Fiber)

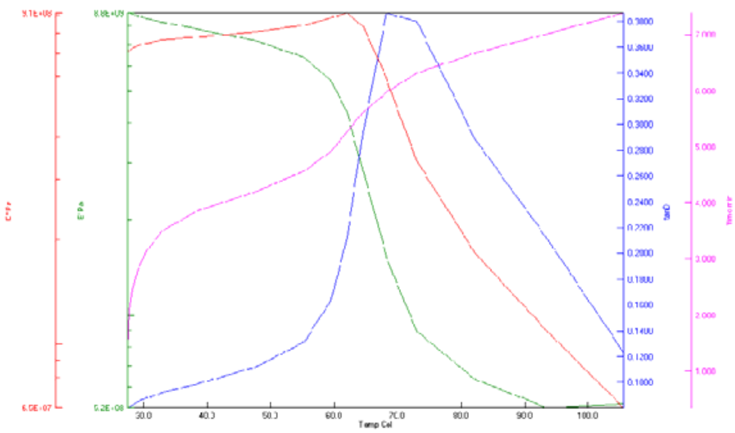

Fig 9: Shows MDA results (E', E" and tan delta) for polymer dampening material (0.5 gr. Banana + Glass Fiber)

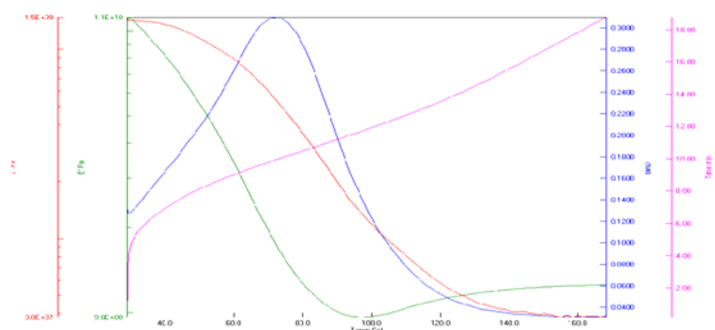

Fig 10: Shows MDA results (E', E" and tan delta) for polymer dampening material (0.7 gr. Banana + Glass Fiber)

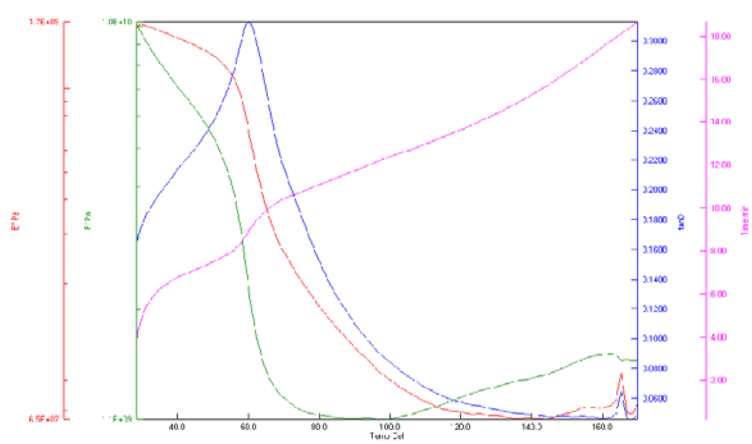

Fig 11: Shows MDA results (E', E" and tan delta) for polymer dampening material (1.0 gr. Banana + Glass Fiber)

5. Conclusions

In the gift work, the Diamond dynamic mechanical instrument of metallic element instruments is employed that is excellently appropriate for the characterization of the elastic properties of Banana & amp; optical fiber bolstered composites. The glass transition will be determined significantly additional simply mistreatment Mecanical dynamic analysis. Additionally, the standard of the composites material, like variation of fiber-matrix adhesion, property profile of the coupling agent, damping behavior, physical property with relevancy temperature is studied.

Based on the work the subsequent conclusions were drawn:

1. Dynamic mechanical properties of Banana and Banana & optical fiber bolstered general purpose organic compound (GPR) composites ar greatly hooked in to the degree fraction of the fiber.
2. The dynamic modulus shows a decrease with incorporation of fiber below the glass transition temperature and includes a positive result on the modulus at temperatures on top of Tg.
3. The most improvement in properties is determined for composites with one gram fiber loading, that is chosen because the important fiber loading. At this most fiber loading i.e., 1gram, the loss modulus peak gets broadened accenting the improved fiber/matrix adhesion.
4. What is more, an extra peak happens at high fiber loading within the tan δ curves, thanks to the layer result.
5. Addition of fiber lowers the tan δ peak height that once more points to the improved fiber/matrix adhesion. The glass transition temperature is shifted absolutely on the addition of fiber.

6.0 References

1. Nielsen LE. Mechanical properties of polymers and composites, 1974.
2. Kumar A, Gupta R. Fundamentals of chemical compound engineering. 2nd ed. New York: Marcel Dekker, 2003.
3. Ghosh P, Bose NR, Hindu deity BC, Das S. Mecanical dynamic analysis of FRP composites supported totally different fiber reinforcemnts and synthetic resin because the matrix material. J Appl Polym Sci. 1997; 62:2467-72.
4. Karbhari V. Wang letter of the alphabet. Multi-frequency dynamic mechanical thermal analysis of wetness uptake in E-glass/vinylester composites. Compos half B-Eng 2004; 35(4):299-304.
5. Saha AK, Das S, Bhatta D. Hindu deity BC. Study of jute fiber strengthened polyester composites by Mecanical dynamic analysis. J Appl Polym Sci. 1999; 71:1505-13.
6. Nishar Hameed, Sreekumar PA, Bejoy Francis, Weimin principle, Sabu Thomas. Morphology, dynamic mechanical and thermal studies on poly (styrene-co-acrylonitrile) changed epoxy resin/glass fiber composites. Appl. sciences and manufacturing, 2007.
7. Wielage B, Lampke TH, Utschick H, Soergel F. process of natural-fiber strengthened polymers and therefore the ensuing dynamic-mechanical properties. J of fabric process., 2003.
8. Velmurugan R, Manikandan V. Mechanical Properties of palmyra/glass fiber hybrid composites. Compositesa, 2007.
9. Laly Pothan A, Zachariah Omen, Sabu Thomas. Mecanical dynamic analysis of banana fiber strengthened polyster composites. Composites science & technology, 2003.
10. Geethamma VG, Janardhan R, Ramamurthy K&amp, Thomas S. soften flow behavior of short fibre fiber strengthened natural rubber composites. Int J Polym momma 1996; 32:147-61.
11. Zhang. Z, Klein P, Friedrich K. Dynamic Mechanical properties of PTFE primarily based short carbon fibre strengthened composites: experiment and artificial neural network prediction. Composites science and technology, 62(7-8), 1001-1009.
12. Wolfrum J, Ehrenstein G, Avondet M. Dynamic mechanical thermoanalysis of high performance strengthened materials. J work unit Anal Calorim 1999; 56(3):1147-54.
13. Hatakeyama T, Quinn F. Thermal analysis: fundamentals and applications to chemical compound science. 2nd ed. Chichester, UK: John Wiley & Sons, 1999.
14. Varghese S, Kuriakose B, Thomas S, Koshy AT. Mechanical and elastic properties of short fiber strengthened natural rubber composites: effects of surface adhesion, fiber loading and orientation. J Adhes Sci Technol. 1994; 8:235-48.