A Review of Analysis for Various Mechanical Properties of Composite Materials

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***Abstract*: - Because of advantages of composite materials over traditional materials, use of composite is increasing in all over engineering applications. Now days composites are used in various sectors like aerospace, military applications, automotive industries, marine products etc. Composite is a material that is formed by combination of two or more materials having different properties. It is actually a manmade material. Concrete, fiber reinforced polymers are some of the examples of composites. In case of traditional materials owing to their fixed composition, mechanical properties are readily available in reference books or design data books. However ever in case of composite material for particular application, owing to its composition, it is essential to test the physical, chemical and mechanical behavior of the same before the actual use to check suitability of composite material for that particular application. This paper is an attempt to review the efforts made by various researchers regarding the tensile properties of glass epoxy composites. The researchers all over the world have worked in this regards for different composites and various applications.**

***Index Terms*: -Composites, mechanical behavior of composites, tensile properties of composites, glass epoxy, fiber volume.**

I. INTRODUCTION:-

Composite is the material that is made from different substances. It comprises of different materials, in the combination with quantitative variations hence the properties of composites are always different from their parent materials. The first manmade composite was brick. Plywood is another well known example of composites. A lot of research is going on with the composite properties due to the requirement in various sectors. The composite consist of two phases

I) Matrix phase – it is the primary phases in continuous manner that share the loads with dispersed phase.

II) Reinforcing or dispersed phase- it is the discontinuous phase that is embedded in the matrix phase. It is stronger than matrix phase.

Generally composites are classified in the following manner

i) Metal matrix composites- it is the combination of metal and ceramic.
ii) Ceramic matrix composite- it consists of ceramic material in the matrix form and embedded fibers of other ceramic materials.
iii) Polymer matrix composites- it consist of matrix of unsaturated polymer epoxy etc. and embedded glass, carbon etc. in dispersed phase

Despite of these various types, owing to the fact that the behavior of composite material is different from its parent material, it becomes necessary to study various properties of composites prior to its utilization for particular application. Due to the mechanical properties like higher specific strength and higher specific stiffness, glass epoxy composites are widely used in aircrafts, space crafts and structural applications. Tensile properties are also important regarding these applications. Various researchers have added their contribution in this particular field, and some useful results were concluded.

II.CONTRIBUTION BY VARIOUS RESEARCHERS

T. Peijs. Et.al.[1] investigated the time dependent failure behaviour of loaded composites, assuming that fracture is Gantry. dominated. the yield and fracture behaviour of a neat epoxy system is investigated under various multi-axial loading conditions.

Shao-yun fu et.al.[2] have studied the Effects of fiber length and fiber orientation distributions on the tensile strength of short-fiber-reinforced polymers and it was concluded that remarkable variations are observed on tensile strength owing to variations in fiber length and fiber orientation distribution.

X, Q. Peng et.al. [3] present a novel procedure for predicting the effective nonlinear elastic module of textile composites through a combined approach of the homogenization method and the finite element method the homogenization method is used first to obtain the effective elastic limit of the fibre and resin composite and the properties of the constituent phases.

Kintak et.al [4] have evaluated the natural frequency of composite beams. The results show that the natural frequency of composite beams decreases with increase in the numbers of SMA wires that are clamped at the both ends of the beams.

M. Danieal [5] has studied about fatigue resistance with fiber content and fabric architecture. The material characteristic regarding tensile fatigue behavior has been explored in this research work.

Akira Kuraishi [6] et.al have conducted various tests like tension test, four point bending test for carbon composite panels. A statistical data for material strength is developed through this research.

J M Coram et.al [7] have completed the research regarding durability based design criteria. The objective of study is about laminate failure and unidirectional loading various cases. Conclusion regarding laminate strength of composites was also highlighted in this study.

Mahmood M. Shokriech [8] has also studied regarding leaf spring. The research shows that the stresses in composite leaf spring are much lower than that of steel spring. It is further concluded that natural frequency of composite leaf spring is too enough to avoid the resonance.

Gulur Siddaramanna et.al. [9] have done design, analysis and Testing for End Joint of Mono Composite Leaf Spring for Light Weight Vehicle. The research work was to design and analyze GFRP mono leaf spring and the results were satisfactory.

Vijaya Lakshmi [10] has conducted the static and dynamic analysis of composite leaf spring using Ansys software. The research concludes that glass epoxy is the best material to manufacture the leaf spring.

M Raghavendra [11] studied about weight of epoxy glass composite. His study concludes that due to the use of epoxy glass composite leaf spring considerable weight reduction can be achieved and also considerable reduction in stresses.

Ranjit Mithari [12] has studied about load and displacement of glass epoxy composites. The design and analysis of composite leaf spring has also been done.

Y. N. V. Santhosh Kumar et.al. [13]have performed Design and Analysis of Composite Leaf Spring and it was concluded that design stresses are much below the strength properties of the material.

Sorathiya Mehul et.al. [14] have done Analysis of composite leaf spring using FEA for light vehicle mini truck and it was concluded that load carrying capacity, stiffness, strength are comparable and well within the design limit.

Pankaj Saini [15] has carried out the research on design and analysis of composite leaf spring. It was concluded that the static analysis results that there is a more displacement in the steel leaf spring compared to the corresponding displacements in composites, and all the values are below the camber length for a given uniformly distributed load.

E Mahdi [16] has studied about carbon epoxy, glass epoxy composites. Various tests were conducted like tension, compression and torsion. The conclusion is regarding the carbon or glass epoxy springs and load carrying capacity of composite springs.

Tsai and Hahn,[17] have investigated for the Classical Laminate Theory (CLT) and it was concluded that the stiffness of the component can be changed according to stacking sequence which allows for the tailoring of the material to achieve the desired natural frequencies and respective mode shapes without changing its geometry drastically or increasing its weight.

III.CONCLUSION

Owing to careful study and reviewing the valuable outcomes of various researchers it can be concluded that

i) Glass epoxy composite has good potential for applications in automotive sector replacing the conventional material.
ii) In automotive sector fatigue resistance, tensile strength, impact resistance are more important in various applications like leaf spring etc.
iii) Owing to the variation in composition and proportion of the constituent the mechanical properties of composites are varying and hence needed to be extensively studied for further applications.

Detailed study and analysis of glass epoxy composite which is significant for further developments in automotive sectors is yet not attended and addressed by researchers.

IV.PROPOSED WORK

Owing to the outcomes of review of efforts made by various researchers in the field of study of mechanical properties of composites; the potential for further study in this field is sensed and is proposed to be done. The proposed work is regarding detailed study and analysis of glass epoxy composite for variation in fiber volume and for tensile strength.

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