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Using of Ansys Program to Calculate the Mechanical Properties of Advanced Glass Fibers Composite

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ABSTRACT
This research paper is about to analysis of glass fiber composite by ansys software .Glass fibers composites have been prepared by various manufacturing technology and are widely used for various applications. Initially, ancient Egyptians made containers by glass fibers drawn from heat softened glass. Continues glass fibers were first manufactured in the 1930s for high-temperature electrical application. Nowadays, it has been used in electronics, aviation and automobile application etc. Glass fibers are having excellent properties like high strength, flexibility, stiffness and resistance to chemical harm. It may be in the form of roving's, chopped strand, yarns, fabrics and mats. Each type of glass fibers have unique properties and are used for various applications in the form of polymer composites.
The complete of study has been conducted in three parts
i) Study about E-glass fiber
ii) Analysis of different orientation of fiber
iii) Final results
Keyword glass fiber , epoxy, mechanical property, modulus of elasticity, stress, strain, deflection.

I. INTRODUCTION

A solid material that results when two or more different substances ,each with its own characteristics are combined to create a new substance whose properties are superior to those of the original components in a specific application.

Composite materials are made from two or more different types of material. For example , MDF is made from wood fibres and glue, and fibreglass is made from a mesh of glass fibers set in a tough polymer. Composite are usually classified by the types of material used for the matrix. The four primary categories of composites are ;

1) Polymer matrix composites (PMNs)
2) Metal matrix composite (MMCs)
3) Ceramic matrix composites (CMCs)
4) Carbon matrix composites (CAMCs)

Objective

1) To find out the mechanical properties of E-glass fiber composite with different fiber orientation
2) To find the behaviour of E-Glass fiber

II. METHODOLOGY

Using ansys software to checking the stress, strain, deflection and modulus of elasticity of different orientation of glass fiber composite (45,60,30,90)

Ansys is an American company based in Canonsburg, Pennsylvania. It develops and markets CAE/multiphysics engineering simulation software for product design, testing and operation and offers its products and services to customers worldwide.
Ansys was founded in 1970 by John Swanson, who sold his interest in the company to venture capitalists in 1993. Ansys went public on NASDAQ in 1996. In the 2000s, the company acquired numerous other engineering design companies, obtaining additional technology for fluid dynamics, electronics design, and physics analysis. Ansys became a component of the NASDAQ-100 index on December 23, 2019.

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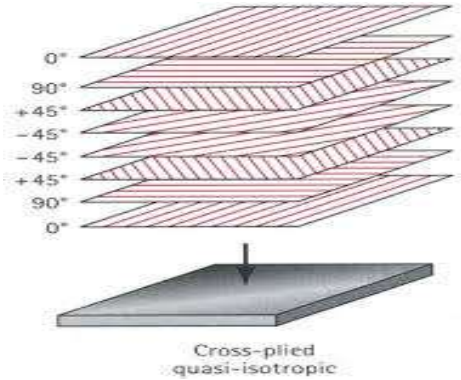


EXPERIMENTAL PROGRAM

We are taking five layer of glass fiber of 0.15mm thickness and orientation of (0, 90,),(+30,-30),(+45,-45)

Note

We know the below value from literature review

1) Young modulus in x direction 5×10^{10}
2) Young modulus in y direction 8×10^{9}
3) Young modulus in z direction 8×10^{9}
4) $PR_{xy} = 0.3$
5) $PR_{yz} = 0.4$
6) $PR_{xz} = 0.3$
7) $G_{xy} = 5\times 10^{9}$
8) $G_{yz} = 3.8\times 10^{8}$
9) $G_{xz} = 5\times 10^{9}$

DENSITY OF E-GLASS FIBER

$2.54 g/cm^3$

III. ANALYSIS OF RESULT

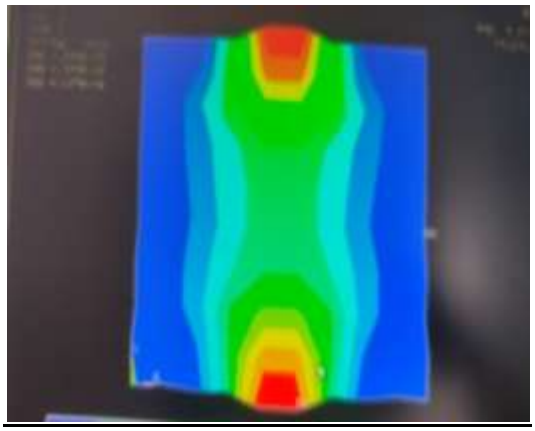
Thickness of sheet =0.15mm

(Orientation of 0,90)

In this experinment we considering the 5 layer of sheet fiber fixed with all side and applying 25000 pascal load on y direction only.

(0,90) 0rientation stress

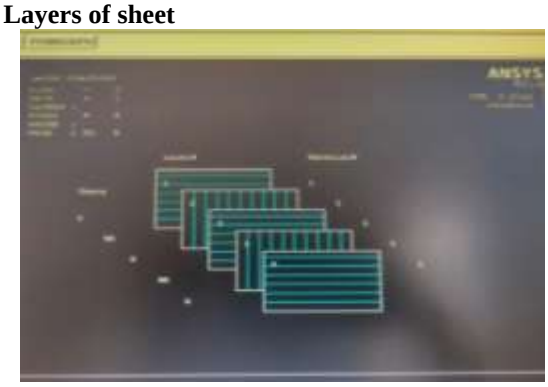
DMX= .494E-05 (Deflection at x direction)
SMN =1319.14(minimum shear stress)
SMX= 130463(maximum shear stress)



(0,90) 0rientation strain

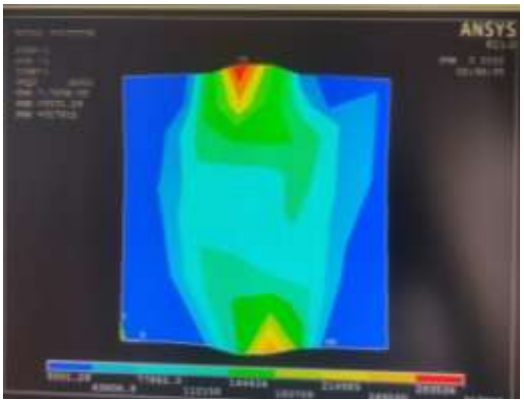
DMX= .594E-05 (Deflection at x direction)
SMN =.632E-06(minimum strain)
SMX= .254E-04(maximum strain)

Layers of sheet



(Orientation of +30,-30)

In this experinment we considering the 5 layer of sheet fiber fixed with all side and applying 25000 pascal load on y direction only.



(+30,-30) 0rientation stress

DMX= .765E-05 (Deflection at x direction)

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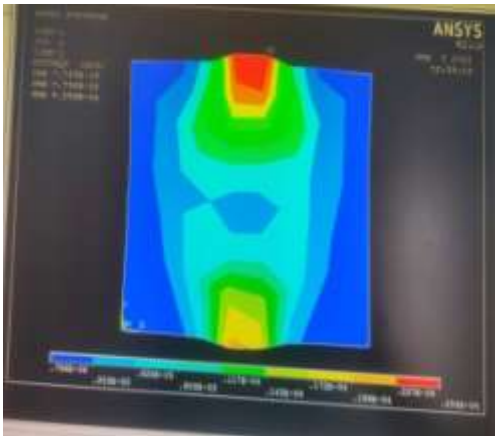
SMN =9331.29(minimum shear stress)
SMX= 317812(maximum shear stress)

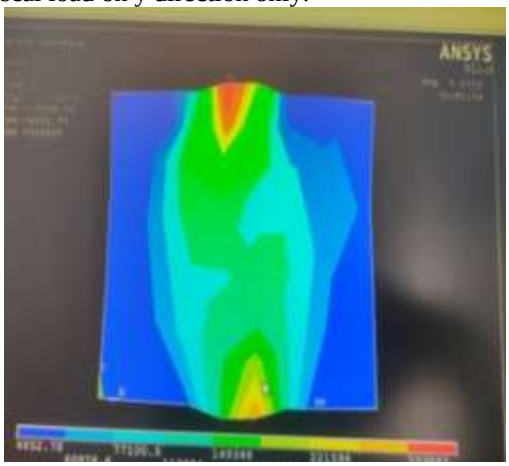


(+30,-30) 0rientation strain

DMX= .765E-05 (Deflection at x direction)
SMN =.796E-06(minimum strain)
SMX= .254E-04(maximum strain)

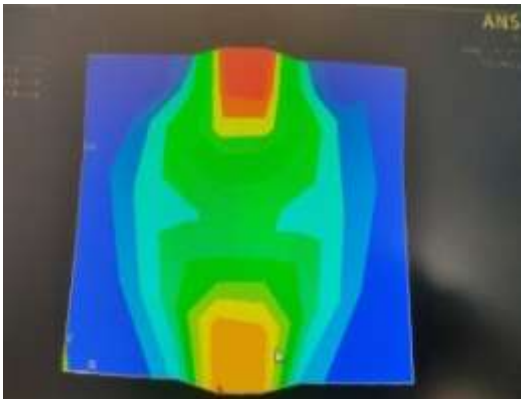
(Orientation of +45-45)

In this experinment we considering the 5 layer of sheet fiber fixed with all side and applying 25000 pascal load on y direction only.



(+45,-45) 0rientation stress

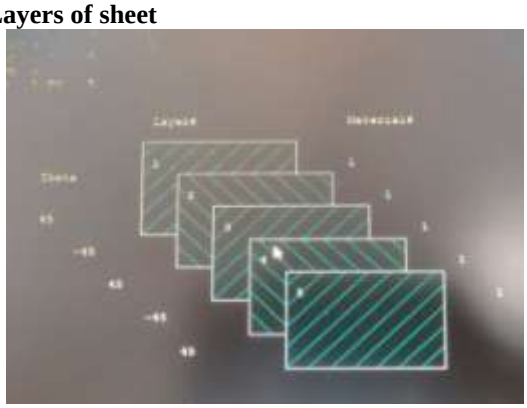
DMX= .561E-05 (Deflection at x direction
SMN =4852.78(minimum shear stress)
SMX= 329967(maximum shear stress)



(+45,-45) 0rientation strain

DMX= .561E-05 (Deflection at x direction)
SMN =642E-05(minimum strain)
SMX= .253E-04(maximum strain)

Layers of sheet



(Orientation of +60-60)

In this experinment we considering the 5 layer of sheet fiber fixed with all side and applying 25000 pascal load on y direction only.

(+60,-60) 0rientation stress

DMX= .497E-05 (Deflection at x direction)
SMN =5187.78(minimum shear stress)
SMX= 3199645(maximum shear stress)

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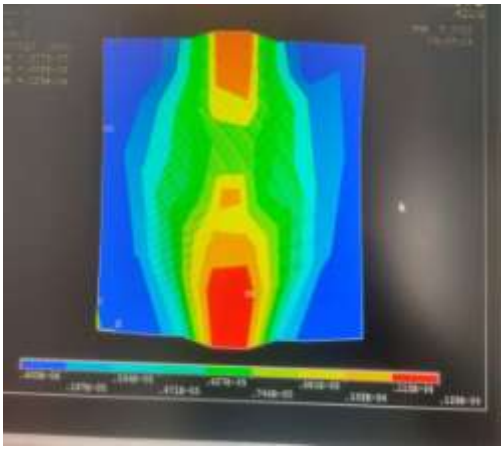


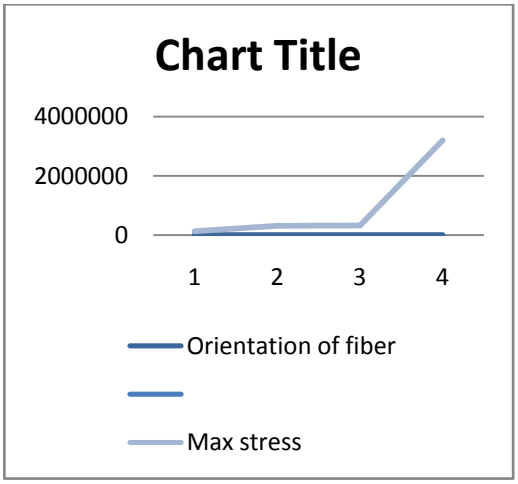
(+60,-60) 0rientation strain

DMX= .477E-05 (Deflection at x direction)
SMN =.605E-06(minimum strain)
SMX= .129E-04(maximum strain)

IV. RESULTS

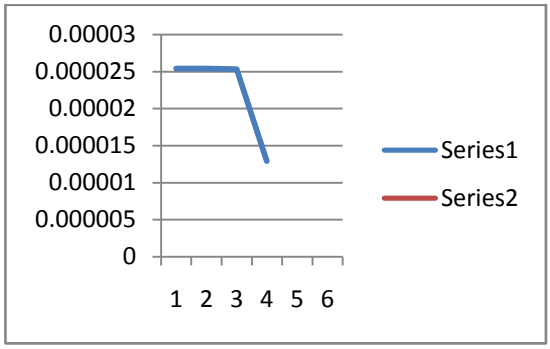
Maximum Stress

Orientation of fiber	Max stress
90	130463
30	317812
45	329967
60	3199645



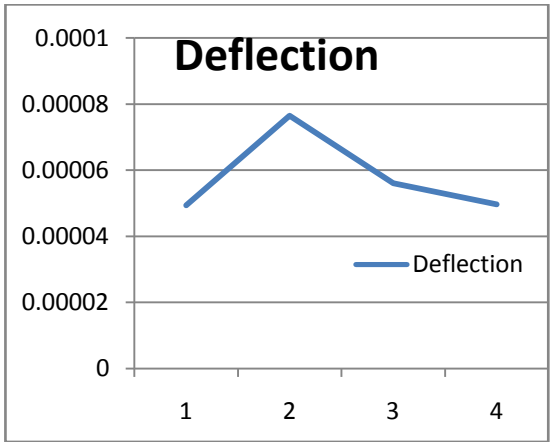
Maximum Strain

Orientation of fiber	Max strain
90	0.0000254
30	0.0000254
45	0.0000253
60	0.0000129



Deflection

Orientation of fiber	Deflection
90	0.0000494
30	0.0000765
45	0.0000561
60	0.0000497



Modulus Of Elasticity

Orientation of fiber	Modulus of elasticity
90	5136338583
30	1.25122283×10^{10}
45	1.304217391×10^{10}
60	2.480344961×10^{11}

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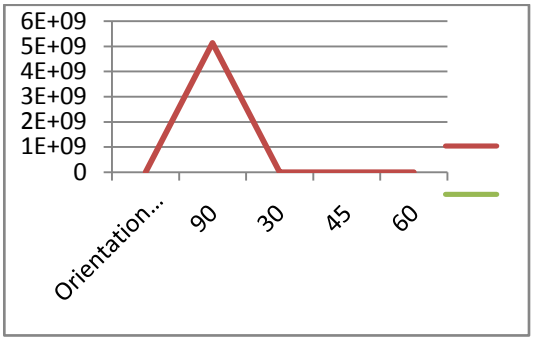

V. CONCLUCTION

1) Maximum stress is coming in 60(0rientation) =3199645
2) Maximum deflection is coming in 30 (orientation)= 0.0000765
3) Maximum strain is coming in 90,30 (orientation) =0.0000254
4) Maximum modulus of elasticity is coming 90 (orientation) = 5136338583

In this project we know the value of stress, strain, modulus of elasticity, deflection of glass fiber composite (different orientation of fiber). In future if any one go for further experiment they can used this result

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