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Preparation and Analysis of Hybrid Epoxy Composites

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Abstract:
The project is largely based on composite materials. Composite materials are a combination of any two or more constituents, when combined form a different material altogether with characteristics different from any individual constituents. The project deals with the fibre glass reinforced composite. The project was carried out at a FRP based manufacturing company. It manufactures bus outer body and some inner body panels. , when the panels are being prepared the fiberglass material protrudes outside of the mold. This material is cut and thrown away. Since it contains resin which is not biodegradable, the whole of the waste material is burnt. After the material is completely burnt, the resin burns away but the strands of glassfibre remain unburnt. The idea behind the project is to see whether the remaining strands of glassfibre can be reused in the manufacturing process. The tests are conducted and the results reveal whether reuse can be done or not.

I. INTRODUCTION

A composite material is made by combining two or more materials – often ones that have very different properties. The two materials work together to give the composite unique properties. Composites are made up of materials referred to as constituent materials. There are two main categories of constituent materials, Matrix and reinforcement. At least one portion of each type is required. The matrix material surrounds and supports the reinforcement materials by maintaining their relative positions. The reinforcements impart the special mechanical and physical properties to enhance the matrix properties. A synergism produces material properties unavailable from the individual constituent materials, while the wide variety of matrix and strengthening materials allows the designer of the product or structure to choose an optimum combination.

II. METHODOLOGY

Materials used

Fibre Glass

Fiberglass is a strong lightweight material and is used for many products. Although it is not as strong and stiff as composites based on carbon fiber, it is less brittle, and its raw materials are much cheaper. Its bulk strength and weight are also better than many metals, and it can be more readily molded into complex shapes.

Figure.1. Fibre glass

Fiber type	Tensile strength (MPa)	Compressive strength (MPa)	Density (g/cm^3)	Thermal expansion (µm/m·°C)	Softening T (°C)
E-glass	3445	1080	2.58	5.4	846

Epoxy resin

The type of epoxy resin used is C51 Lapox conventionally known as modified epoxy resin. The resin acts as the matrix for the composites to bind the composite material together and transfer the component forces that may act on the part of the fibres in the composite material. The fibres are considered and selected to handle the designed stress imposed. In this experiment epoxy and harderner resin system will be used.

Specimen preparation

the specimen is prepared by hand layup method. Here the epoxy resin of type C51 Lapox and the matrix material is fibre glass. A single specimen was prepared and various tests were conducted.

Figure.2. specimen slab

TESTING

After preparing the specimen, the tensile and Izode impact tests are conducted.

Tensile test

Usual tensile test can be performed on prepared composites. Before testing, tensile test specimens are prepared according to ASTM standards. Specimens of size (250*15*5) mm are used for testing. Tabs are attached on either side of straight sided

specimens which are gripped in the testing machine. Load value is obtained from the testing and change in length is calculated by using extensometer. Tensile strength and young's modulus are found out using the following formula.

$\rho = F/A$

$E = \rho L/\delta$

Where F is the load applied in N, A is the area of the cross section in mm^2, ρ is the tensile strnght in MPs and E is young's modulus in GPa, δ is the change in the length in mm and L is the original length in mm.

Izode impact test

Usual impact test can be conducted on impact test machine. Before testing the test specimen is prepared according to the ASTM standard. Specimen is of size 60x12x5 mm. Energy absorbed is obtained from the test.

III. RESULTS AND CONCLUSIONS

TENSILE TEST

Specimen no.	Available results	Experimental results
1	**72.36 N/mm^2**	**48.72 N/mm^2**

Error in the result:

E = (72.36 - 48.72) / 72.36
= 24.16 / 72.36
= 0.3338
E%= 0.3338*100
= 33.38

IMPACT IZOD TEST

Specimen no.	Available results	Experimental results
1	**376.36 J/m**	**306.73 J/m**

Error in the result:

E= (376.36 – 306.73) / 376.36
= 69.63 / 376.36
= 0.1850
E% = 0.1850*100 = 18.50

IV. CONCLUSION

As we can see in the tensile test case that the error is 33%. This makes us conclude that the error is too high and does not fulfill the purpose. This means that the material cannot be reused. In case of the Impact test, the error is 18%. This result also shows us that the material cannot be reused. Since both the results do not agree with the original values, we can finally state the USE **OF THE WASTE MATERIAL IS NOT POSSIBLE** the reasons for the failure of the experiments maybe because the waste strands after being burnt lose their strength, making them fail the tests.

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