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Retraction

Retraction: Experimental investigation of glass fiber reinforcement with nano materials (*IOP Conf. Ser.: Mater. Sci. Eng.* **1145** 012096)

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This article (and all articles in the proceedings volume relating to the same conference) has been retracted by IOP Publishing following an extensive investigation in line with the COPE guidelines. This investigation has uncovered evidence of systematic manipulation of the publication process and considerable citation manipulation.

IOP Publishing respectfully requests that readers consider all work within this volume potentially unreliable, as the volume has not been through a credible peer review process.

IOP Publishing regrets that our usual quality checks did not identify these issues before publication, and have since put additional measures in place to try to prevent these issues from reoccurring. IOP Publishing wishes to credit anonymous whistleblowers and the Problematic Paper Screener [1] for bringing some of the above issues to our attention, prompting us to investigate further.

[1] Cabanac G, Labbé C and Magazinov A 2021 arXiv:2107.06751v1

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Experimental investigation of glass fiber reinforcement with nano materials

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Abstract. The development of reinforced composite fibre has received a lot of attention in recent years.Reinforced composite fibres have superior mechanical properties to glass and carbon fibre, such as stiffness, impact strength, durability, and modulus. Poor moisture tolerance and the formation of its forms during processing render it more difficult to use them in a specific application. The effect of adding silica nano particle content to a glass fiber-reinforced composite fabricated through hand lay-up followed by hot press moulding is investigated in this study, and mechanical properties such as tensile strength, flexural strength, and impact strength are evaluated. The findings showed that when 5 percent Nano-silica is applied to the glass fibre, optimum tensile and flexural strength is obtained, and that the addition of 1 percent Nano-silica has major effects on the Charpy impact behaviour.

Keywords: Synthetic Fibres, Glass Fibre, Nano-silica , Epoxy resin.

1.Introduction

As compared to other materials, fibre-reinforced composites have a high strength to weight and modulus to weight ratio[1]. Fiber and matrix are the two components that make up FRC. Synthetic fibre reinforced composites (SFC) have superior mechanical properties to natural fibre reinforced composites. A Synthetic Fibre Reinforcement composite is a structural substance made up of two or more mixed constituents that are not soluble in each other on a macroscopic basis. The properties of composites are superior to those of individual components when used alone [2,3].Epoxy polymers are amorphous, tightly crosslinked materials used in composite materials as adhesives and matrices. Many useful properties arise from this chemical structure, including high modulus and failure strength, low creep, and high-temperature efficiency [4,5].

The main aim of this research was to see what happened when nanosilica was impregnated into secondary reinforcement, epoxy matrix-glass fibre composite laminates. tensile, three-point bending, quasi-static indentation measurements, and dynamic mechanical analysis were used to evaluate the properties of composites containing1%,3%, and 5% nanosilica[6]. Using beam bending experiments on uniaxially aligned material, the effect of fibre length on the strength of glass fibre-epoxy resin composites was investigated. The essential fibre length is found to be 12.7 mm, which fits theoretical projections very well. (0.5 in.) [7,8]. Nanoparticles added to epoxy resins can boost

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properties such as a wider range of glass transition temperatures, a slight increase in glassy modulus, a low dielectric constant, and significant improvements in key mechanical properties. [9,10].

1.1 Properties of glass fiber

The tensile strength of glass fibre of the same diameter and weight is higher than steel wire of the same diameter and weight. A low elongation load of less than 3% is described as dimensional stability. Glass fabrics have a high heat resistance: at 700°F, they maintain 50% of their room temperature tensile power, 25% at 900°F, a softening point of 1,555°F, and a melting point of 2,075°F. Fire resistance: The product is non-combustible since it is made of inorganic materials. Good thermal conductivity: Because of their large surface area to weight ratio, glass fibres are excellent thermal insulators. Chemical resistance is excellent: it can withstand a wide range of chemicals. Electrical properties that are exceptional: Has a low dielectric constant and a high dielectric power. Durability: UV, fungi, and bacteria are not a problem. Economical: As compared to equivalent goods, this is the most cost-effective choice. Fibreglass is durable and can be coloured, shiny, or dull. It's low-maintenance, anti-magnetic, fireproof, electrically insulating, and weatherproof.

Table 1. Properties of glass fibre

Properties	Glass Fiber
Density (kg/m^3)	2600
Hardness (MPa)	6000
Tensile strength (MPa)	2050
Young's modulus (GPa)	85

2. Experimental

2.1 Materials

Glass fibers, Epoxy Resin Ly 556, Epoxy Hardner Hy – 951and Wax polish aasmaa – 200 GM brown were brought from Covai Seenu, Coimbatore, Tamil Nadu, India. Figures 1 and 2 shows glass fibre and Epoxy Resin, Epoxy hardener, Wax

Figure 1. Glass Fibre

Figure 2. Epoxy Resin, Epoxy hardener, Wax

2.2 Preparation of Glass fibre Sheets

Glass fibre sheets is cut in accordance to the dimension of orientation plate (30x30 cm). We manufactured 3 Glass fibre plates consisting 200gm of glass fibre each. Each Glass fibre plate consist of 12-14 sheets.

2.3 Compression moulding

Wax is applied to both the top and bottom plates of compression moulding machine. Epoxy Resin Ly 556 (180 gm) and Epoxy Hardener Hy – 951 (20 gm) are mixed well. Nano-Silica is added in 1%

ratio. The glass fibre (Layer 1) is kept in the bottom plate with 90-degree orientation. The epoxy nano-silica mixture is spread over the glass fibre using the hand lay-up process. Then another layer of glass fibre is placed above, the epoxy nano-silica mixture is applied again. This process is repeated for the remaining sheets and resin. Then the compression moulding machine is pressed with the pressure of 1500 psi and the temperature is kept constant with 100 degree Celsius. Then, it is heated for a 1 hour and cooled for 3 hours. Finally, the plate is formed with the thickness of 3mm.The other 2 plates are fabricated in this same process using nano-silica in 3% , 5% ratio to the epoxy resin mixture. Figures 3-5 shows compression moulding process and samples

Figure 3. Compression moulding process

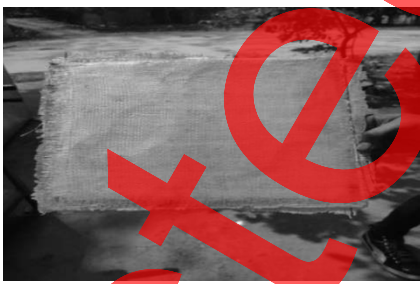

Figure 4. Sample 1 (1% nano-silica)

Figure 5. Sample 2 (3% nano-silica)

3. Result and discussion

3.1 Experimental Result

3.1.1 Tensile test

The maximum amount of tensile stress a material can withstand before failure is defined as its tensile strength. The dog-bone model is the most commonly used tensile testing model. A uniaxial charge is applied to both ends of the specimen during the testing procedure. Standard ASTM D3039 (250x25x3.2 mm). The dimensions of the specimen are listed below. Ultimate tensile and yield pint for permanent deformation, as well as the point of breakup (R) or fracture where the specimen is broken into parts, are all included in the material. The Instron 1195 universal testing machine (UTM) is used to perform the tensile test, and the results are evaluated to determine the tensile force. The configuration of the tensile test machine is shown below. As seen in the images below, the specimen before and after tensile testing. As shown in the table 2 below, the tensile test values. As seen in the graph below, tensile strength varies. Figure 6-9 shows sample and tensile strength

IOP Conf. Series: Materials Science and Engineering 1145 (2021) 012096 doi:10.1088/1757-899X/1145/1/012096

Figure 6. Sample 3 (5% nano-silica

Figure 7. Tensile testing machine

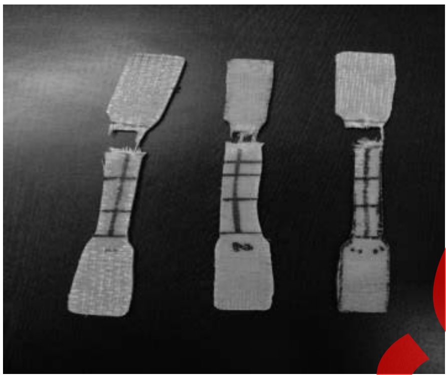

Figure 8. Specimen before and after tensile testing

S.NO	SAMPLES	TENSILE STRENGTH (MPa)
1	Sample 1(1% nano-silica)	289.23
2	Sample 2(3% nano-silica)	299.44
3	Sample 3 (5% nano-silica)	330.4

Table 2. Tensile strength

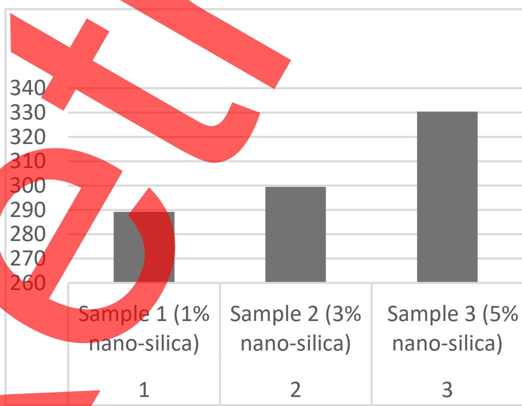

Figure 9. Tensile strength bar chart

3.1.2 Flexural test

The ability of materials to withstand deformation under load is known as flexural resistance. The value of inter-laminar shear strength in composites is calculated using short beam shear (SBS) tests (ILSS). It's a three-point bend test that results in inter-laminar shear failure. This test is performed using UTM and follows the ASTM D790 (127x12.7x3.2mm) standard. The loading arrangement is depicted in the diagram. The specimen's dimensions have already been described.It's calculated by filling the desired shape specimen with a span length that's at least three times the depth. The modulus of rupture is a measure of flexural power (MPa). Figure 10 below shows the configuration of the flexural test unit. Figure 11 below shows the specimen before and after the flexural examination. Table 3 below displays the results of the flexural examination. Figure 12 shows Flexural strength bar chart

Figure 10. Flexural test

Figure 11. Specimen before and after flexural test

Table 3. Flexural strength

S.NO	SAMPLES	FLEXURAL STRENGTH (MPa)
1	Sample 1 (1% nano-silica)	253.91
2	Sample 2 (3% nano-silica)	231.73
3	Sample 3 (5% nano-silica)	279.44

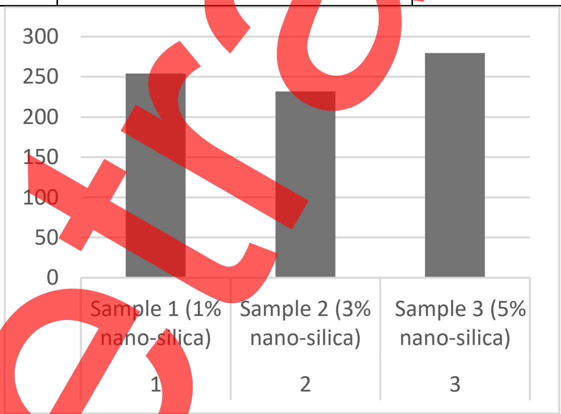

Figure 12. Flexural strength bar chart

3.1.3 Impact test

A test that determines how a specimen of a known material reacts to an unexpected force, such as shock. A notched check piece is typically used, and the Izod or Charpy checks are the two most commonly used methods. The result is normally expressed as the energy required to fracture the test piece in KJ, according to the ASTM D6110 (127x12.7x3.2 mm) standard. As shown in Figure below, the impact test machine is set up. Figure below shows the specimen before and after the impact examination. Table 4 displays the results of the effect test. The Variation of impact strength as shown in the below.

Figure 13. Impact testing machine

Table 4. Impact strength

S.NO	SAMPLES	IMPACT ENERGY (J)
1	Sample 1 (1% nano-silica)	3.49
2	Sample 2 (3% nano-silica)	2.6
3	Sample 3 (5% nano-silica)	3.2

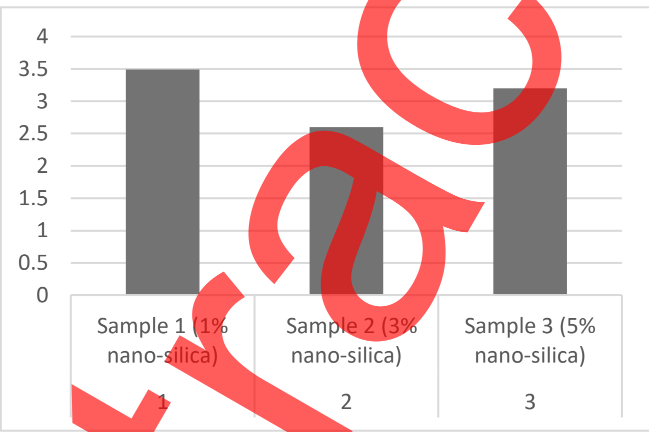

Figure 14. Impact strength bar chart

4. Conclusion

To analyse and evaluate the mechanical behaviour of glass fibre reinforced composites, three types of tests were used. The specimen made is cut as per ASTM standards for Tensile, Flexural and Impact testing and the results of mechanical properties are compared with 1%, 3% and 5% nano-silica ratio.

- A pure glass fibre composite has a tensile strength of 273.50 MPa, but adding 5 wt percent Nano silica increased the tensile strength to 330.40 MPa.
- A pure glass fibre composite has a flexural strength of 237.2 MPa, while adding 5% weight percent increases it to 237.2 MPa. The flexural strength was increased to 279.44 MPa thanks to nano silica.
- The impact strength of a pure glass fiber composite is 2.8J, while adding 1 wt% percent Nano silica improved the impact strength to 3.49J.

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