

## IMPACT PROPERTIES OF EPOXY/GLASS FIBER/NANO CLAY COMPOSITE MATERIALS

S.Sivasaravanan.<sup>1,\*</sup>, V.K.Bupesh Raja<sup>2</sup>,

<sup>1</sup>(Research Scholar, Dept. of Mechanical & Production Engineering, Sathyabama University, Chennai-600119, India.)

<sup>2</sup>( Professor and Head, Dept. of Automobile Engineering, Sathyabama University, Chennai-600119, India.)

**ABSTRACT:** Over the last twenty to thirty years composite materials has been used in engineering field. Composite materials possess high strength and high strength to weight ratio, and due to these facts composite materials are becoming popular among researchers and scientists. The major proportion of engineering materials consists of composite materials. Composite materials are used in vast applications ranging from day-to-day household articles to highly sophisticated applications. In this present investigation hybrid composites of Epoxy/Nanoclay/Glass fiber were prepared by Hand-layup technique. The glass fiber used in this present investigation is E-glass fiber bi-directional: 45° orientation). The composite samples were made in the form of a plate. The wt% of nanoclay added in the preparation of sample was varied, ranging from 1wt% to 5wt%. The fabricated composite materials in the form of plate were cut into corresponding profiles as per ASTM standards for impact testing.

**Keyword:** Hybrid composites, impact strength, Nano clay, Handlay up Techniques.

### 1. INTRODUCTION

Epoxy resin is one of the excellent thermosetting polymer resins. The cost-to-performance ratio of epoxy resin is outstanding. Epoxy resins possess characteristics such as high strength low creep, good adhesion to most of the substrate materials, low shrinkage during curing and low viscosity. Due to these reasons epoxy resins are significantly used as matrix material in many applications such as aerospace, structural applications, ship building, and automobile industries and so on.

The tensile strength and the tensile modulus of Glass fiber/Polypropylene composite decreases with the increase in fiber loading and the addition of Nanoclay particles to the Glass fiber/Polypropylene composite increases the tensile strength and the tensile modulus of the composite. Also, the addition of Nanoclay particles to the Glass fiber/Polypropylene composites increased the flexural properties of the Glass fiber/Polypropylene composite [1]. Nano composites can be used for high strength, stiffness. Nano composites can be used in aerospace, automobile, and marine and lightweight article applications [2].

It has been reported that the addition of Nanoclay to Glass fiber/Epoxy composites increases the interfacial shear strength tremendously [3]. When the addition of filler materials to Epoxy/Glass fiber composites is increased then the thermal expansion coefficient of the corresponding composite gets reduced [4]. The fiber/matrix interface plays a vital role in determining the mechanical properties of glass fiber composites [5].

When the content of Nanoclay is increased beyond an optimal level then the mechanical properties of the resultant composites decreases [6]. The percentage of Nanoclay to be used should be restricted to 5 wt% in order to get good mechanical properties of the composites [7].

### 2. EXPERIMENTAL PROCEDURE

#### 2.1 Materials Used

E-Glass fiber (bi-directional: 45° orientation) is used as reinforcing material, Epoxy resin (LY 556) and hardener (HY 951) is used as the matrix material.

#### 2.2 Method of fabrication

Hand-layup technique is used in the manufacture of the composite material. Due to the economical aspect and simplicity of hand-layup technique, this technique is being used in small and medium scale industries.

**2.3 Preparation of samples**

The samples were prepared based on the ASTM standards for impact The composite samples were prepared by varying the wt% of nanoclay. The wt% of the sample was varied from 1wt% to 5wt%..

**3. Results and Discussions**

**3.1 Impact Testing**

The prepared composite samples were tested for its Impact strength. The value of the impact strength for the samples with different wt% of nanoclay is shown in Table 1, Table 2, Table 3, Table 4 and Table 5.

**Table 1: Impact test results of composite sample with 1wt% Nano clay**

Specimen (1 wt. %)	Force (J/M)
1	9.1
2	10
3	9.8
4	10.2

**Table 2: Impact test results of composite sample with 2wt% Nano clay**

Specimen (2wt. %)	Force(J/M)
1	9.4
2	10.4
3	10.5
4	10.5

**Table 3: Impact test results of composite sample with 3wt% Nano clay**

Specimen (3 wt. %)	Force (J/M)
1	9.8
2	10.6
3	9.8
4	8.1

**Table 4: Impact test results of composite sample with 4wt% Nano clay**

Specimen (4 wt. %)	Force(J/M)
1	10.6
2	10.4
3	10.4
4	8.8

**Table 5: Impact test results of composite sample with 5wt% Nano clay**

Specimen (5wt %)	Force(J/M)
1	10.6
2	11.0
3	10.5
4	10.9

#### **4. CONCLUSION**

The impact test results of nano composite materials improved with addition of nano clay in epoxy matrix. This test was performed by izod testing machine, it was found that addition of 5wt% of nano clay shown very good results compare to other percentage of nano clay, average value of 5wt% of nano clay is 10.75 J/m when compare to other combination of nano composite materials.

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