

Mechanical Properties of Nanocomposites by Using Nanoclay, Glass fiber and Unsaturated Polyester

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ABSTRACT

Mechanical behavior of nano clay filled thermoset composite by hand layup technique has been studied for high performance. USP is used with E-glass fiber and nano clay (MMT) to fabricate nanocomposite. Each individual clay particle offers a large surface area and high aspect ratio. Both of which can be critical in improving mechanical and other properties.

Keywords: Unsaturated polyester resin, Nanoclay, Mechanical properties, Nanocomposites.

1. INTRODUCTION

Nowadays it is evident that clay nanolayers bring about unique properties for various polymeric systems including unsaturated polyester resins. Naturally occurring clay soils are very hydrophilic and as a result they are not highly compatible with unsaturated polyester resins. To enhance the interfacial interaction between nanoclay and organic polymer it is necessary to modify the surface of clay with organic compounds. Polymer layered silicate Nanocomposites are in fact nanometric dispersions having far better properties than conventional composites or the same micro-composites. Recently special attention has been paid to the properties of Nanocomposites. These properties include physical and mechanical properties [1(a,b)], thermal and electrical properties [1(c, d)], flame retardancy [1(e-g)], gas barrier properties [1(h,i)] and shrinkage control behavior [1(j-n)].

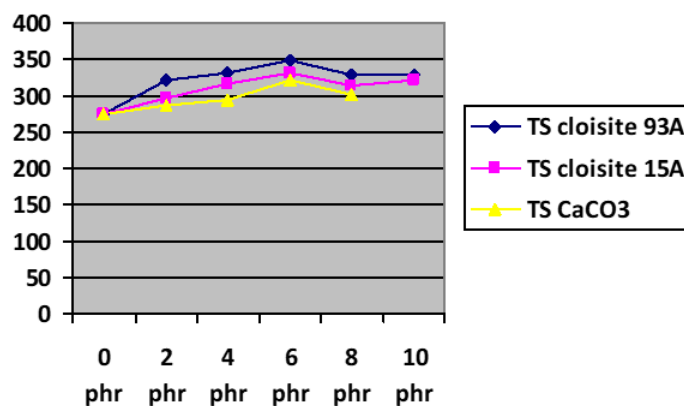
2. EXPERIMENTAL MATERIALS

The Unsaturated polyester resin used (Satyen Pvt. Lmt. Espol17.00; ® -O-RLP) is having Sp. Gravity 1.08 ± 0.02 and viscosity 200 ± 300 while E-glass fiber used is of density 2.55 g/cc . Nanoclays used are Cloisite®93A and Cloisite®15A.

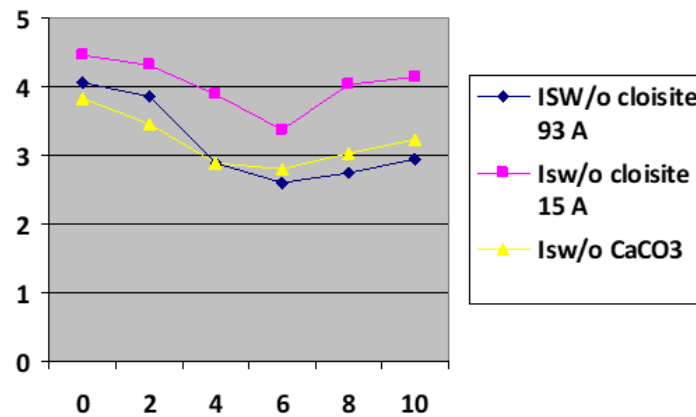
Batch and composite preparation: Batches are prepared with varying percentage of Nanoclay in composite. Hand layup technique is adopted for Nanocomposites preparation. For preparation of thermoset composites, commercial general grade of unsaturated polyester resin is preferred. Initiator (MEKP), accelerator (Cobalt octate) is selected for USP resin. For thermosetting, the composites which are used to prepare test specimens are processed by hand lay-up technique. The initiator 1% and the accelerator 1% is used for USP batch preparation at room temperature curing.

Mechanical Testings: Mechanical tests of various samples were done are as follows: Tensile strength and % elongation, Impact strength.

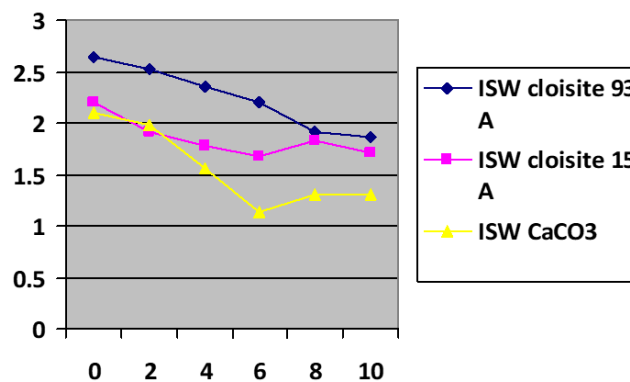
3. RESULTS AND DISCUSSIONS:



Graph 1: Loading of fillers in phr Vs Tensile strength (kg/cm²).



Graph 2: Loading of filler in phr Vs Impact strength without notch (kgm/inch).



Graph 3 : Loading of filler in phr Vs Impact strength with notch(kgm/inch).

Tensile test results for various compositions of Cloisite 93A, Cloisite 15A and CaCO_3 were done according to standard ASTM D638. As shown in graph 1, for all three fillers, the results of tensile testings were increased up to 6 phr and then started to decrease. Hence it is seen that the tensile strength is maximum at 6% loading of Cloisite 93A, Cloisite 15A and CaCO_3 .

The graph 1 gives the behavior of tensile strength & % elongation of USP composite filled with nanofillers. In this case there is increase in tensile strength is observed. We observed at 6 phr loading also all tensile properties are significantly increase. But many scientist reported that up to 3 phr loading it is mainly increase. So further studies is necessary in this case.

The impact properties of USP composite materials obtained are as shown in graph 2 and 3. The test is carried out to bring the accurate impact properties of the composite according to standard ASTM D 256.

There is a marginal decrease in izod impact strength is observed in USP composite with nanofillers as shown in graphs. The decrease in impact strength may be because of non uniform distribution of the nanoclay through out the composite. These results are very well supported by tensile and flexural properties.

4. CONCLUSION:

- From the results of mechanical testings, it is observed that at 6 phr better results are found. In this study, we prepared various compositions and their testings for better performance of composites.
- Tensile strength has been increased up to 6 phr and after that it is seen to be decreased.
- Impact strength has been observed on decreasing up to 6 phr but between 6 to 8 phr, it is increased.

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