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# EFFECT OF MOISTER ON THE MECHANICAL PROPERTIES OF E-GLASS/EPOXY LAMINATES

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## ABSTRACT

Composites materials are the emerging alternate materials rapidly being used in the engineering applications due to the specific advantages which include the ease of processing them to the required size and shape with minimal cost. However, the material behaviour when exposed to the moist environment is effected. In-view of this the present study aims at understanding the effect of moister on the mechanical behaviour of glass/epoxy composites. A considerable effect in the materials tensile and flexural behaviour is observed however there is no much change in the impact behaviour.

**KEYWORDS**: E-glass/Epoxy, Mechanical Properties, plasticization, flexural behaviour of composites.

## I. INTRODUCTION

A progressive use of Composites materials is been observed in various engineering applications due to their specific advantages which cover (i) elevated specific strength, (ii) low density and (iii) high specific stiffness. And the widespread characteristic of composites being a notable anisotropic in nature which has high stiffness and good fracture strength along the fiber direction has also improved its usage. However, these materials in service are exposed to various environmental situations throughout the service life and the materials potential under such conditions are not fully realized. This is due to the fact that it is highly difficult to adopt a processing technique which would not allow the moister absorption during manufacturing.

The behaviour of the composite plates exposed to varying environmental changes such as different moisture content and varying temperature have been the theme of research attention, but most of the studies focuses on the outcome based on the change in operating temperature [l-6]. Fiber /epoxy composite when are immersed in water, experience disproportional swelling in matrix and fiber material due to the water absorption by the two materials. This variation in the volumetric expansion of the two constituent materials generates stresses in the composite on the whole thus reducing the material durability in the service life [7-8]. A significant effect on the physical and chemical properties of the matrix and on the overall performance of the polymer reinforced composites is observed [9].

The present study is focused in understanding the effect of moister content on the mechanical properties of glass/epoxy composites with reverence to different the fiber orientation and different fiber content. [0, 90] and [45] laminates with symmetric and unsymmetrical lay up were considered for the present study.

## II. SPECIMEN PREPARATION

The conventional compression molding technique has been employed in sample preparation. The layers of glass fiber mat based on the required orientation are stacked one after the other by simultaneously applying resin on to the lamina till the required number of layers, i.e., in the present case 6, 7, and 8 layers of the fiber mat. After the layers are stacked a known compressive load is applied on the mould so that the extra resin is removed and the laminates with sound quality are produced. The samples are allowed to cure in the room temperature and later the samples required for the various tests are cut according to the required dimensions according to the testing standards as shown in fig 1. Later a batch of sample for all the orientations and number of layers are dipped in water maintained at the atmospheric pressure and temperature for a year.

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***Fig1: samples***

## III. EXPERIMENTATION

In-view of understanding the effect of moister on the mechanical behaviour of the glass/epoxy laminates three different tests were conducted according to the ASTM standards. The tensile test was conducted according to D3039/D3039M-14where the flexural test was conducted according to D 6272-10, for both the tests the crosshead speed was maintained at 2mm/min. the impact test was conducted by creating a v-notch perpendicular to the sample and the corresponding energy absorption was recorded.

## IV. RESULTS AND DISCUSSION

The results obtained from the testing conducted according to the standards presented in the above section are present in details. The fig 2 –4 represents the variation of the tensile behaviour for the samples with 6 layers, 7layers and 8 layers respectively, with two different fiber orientations [0/90] and [±45º]. For both the fiber orientation the load v/s deflection is piecewise linear. However due to the water absorption the material becomes more brittle and the energy absorption reduces.

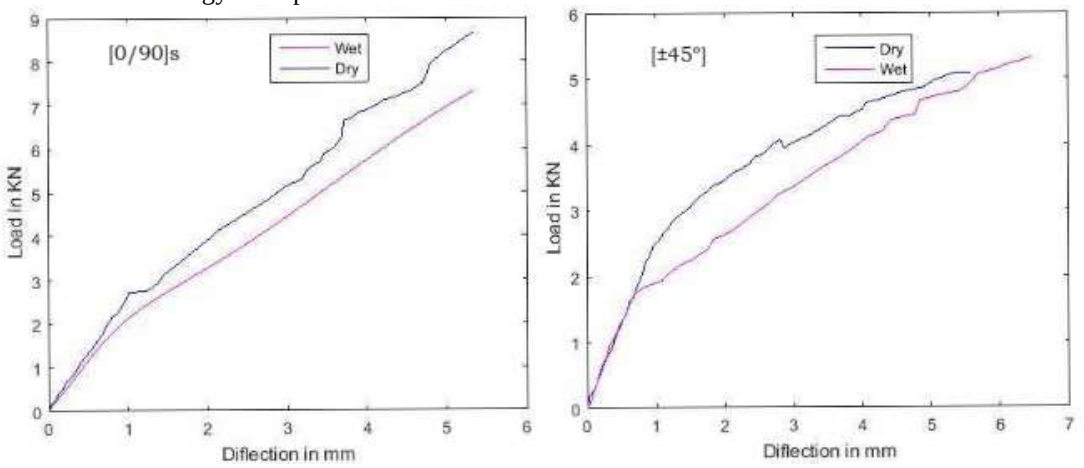


***Fig 2: Load V/S deflection for 6 layers.***

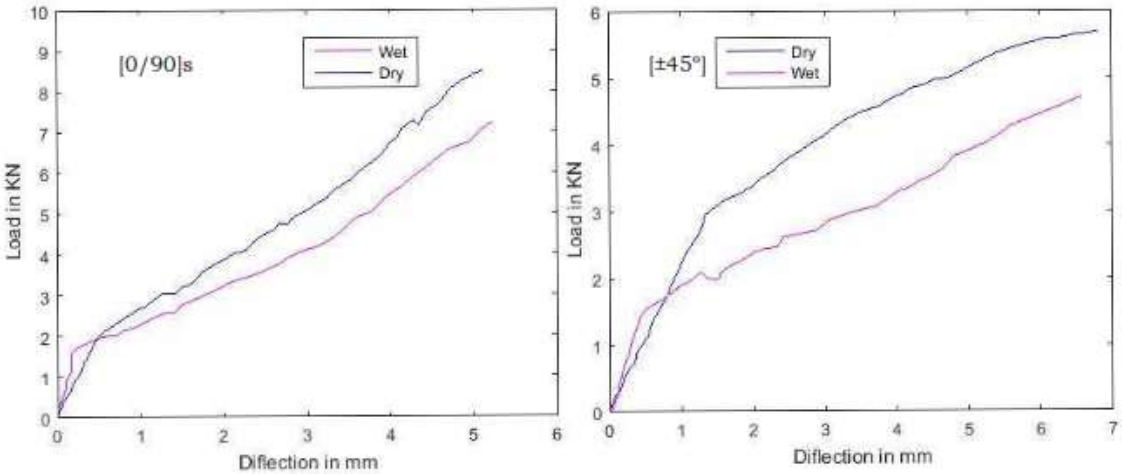


Fig 3: Load V/S deflection for 7 layers.

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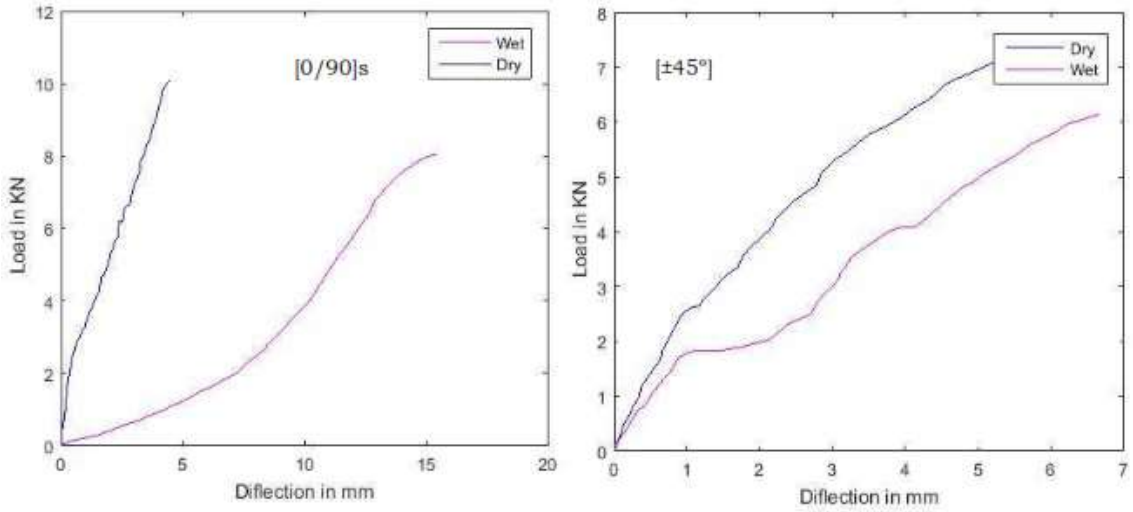


***Fig 4: Load V/S deflection for 8 layers.***

The fig 5 and 6 represents the variation of flexural strength with respect to the number of layers in the sample for both the fiber orientations. There is a decrement in the flexural strength of the laminate for all the samples with different number of layers stacked in both the fiber orientations. However there is high decrement in the flexural strength for the sample with [0/90] orientation. The samples when subjected to izord impact showed no grate change to the moister environment. This is due to the fact that the matrix due to plasticization decreases the bonding capability with the fiber and during impact the load is applied along the cross-section of the sample. This reduces the chance of fibers being pulled out from the matrix phase.

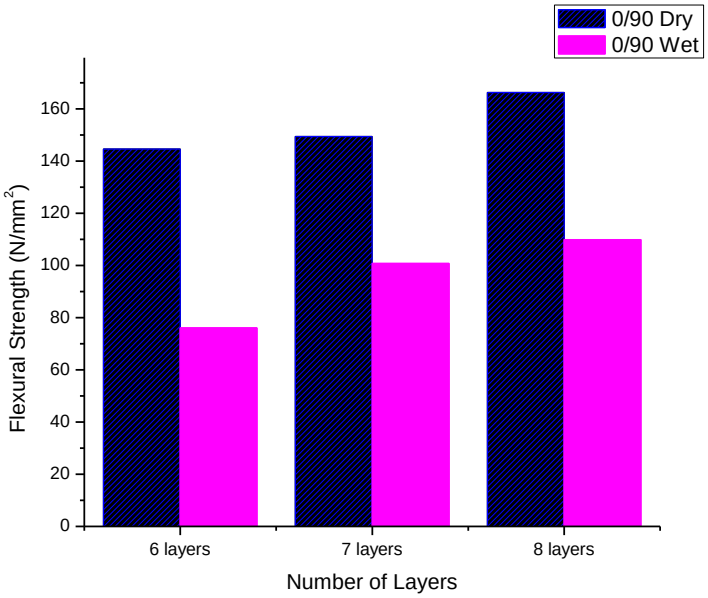


***Fig 5: Variation of flexural strength with respect to [0/90] fiber orientation.***

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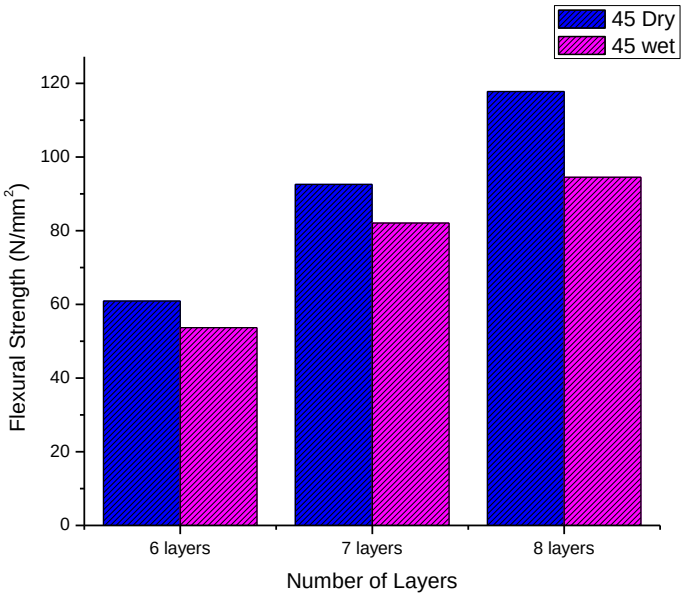


***Fig 6: Variation of flexural strength with respect to [±45º] fiber orientation.***

## V. CONCLUSIONS

The study effectively determined the effect of the environment of the mechanical properties of E-glass/Epoxy composites. The results indicate that there is a considerable effect of moister on the materials tensile and flexural strength of the laminates and there is no much change in the impact behaviour of the laminates. The material behaviors non-linearly for all the causes of the fiber orientation and the reduction in the tensile strength is very high for sample with 8 layers and the fibers oriented as [0/90]. This behaviour due to the presence of micro pores in both the directions in the laminate allowing the moister to seep between the inter lamina. The percentage reduction in the flexural strength is very high for samples with [0/90] fiber orientation.

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