STUDY OF THE PARAMETERS OF SOME REINFORCED ELEMENTS

Lecturer Cătălina IANĂŞI, "Constantin Brâncuşi" University of Tg-Jiu

Abstract*: Over the years, numerous studies have been done on composite materials. These are of interest because of the superior properties they have after combining different materials to obtain the composite material. There are various combinations of materials executed such that in the base material, called matrix, other materials are incorporated that will improve the properties of the material thus obtained. In this study is about a composite material based on an epoxy matrix and carbon fibers for reinforcement which is applied on wood elements and then tested for determining the bending behavior of these elements.*

Keyword: reinforcement, parameters, wood

1. INTRODUCTION

Composite materials have improved qualities compared to the basic material. Their properties depends on the matrix and also the reinforcement elements that help the new material to be more resistant then the basic material. They can have different types of matrix and also different types of embeded elements for obtaining good qualities of the composite material [1,2].

The paper presents some results obtained after the bending tests on a system which is executed from a composite material and wood elements. The composite material is applied on the wood elements with the help of the epoxy matrix then tested for bending.

For the wood elements were choose beams. Many studies have been done on reinforced beams because they are important elements in the construction and they usually have to resist to high bending efforts [3]. Another aspect of these tests is also the dimension of the wood beams, the beam section and the possibilities of combining the beams [4,5]. The beams were tested until broken to determine the maximum bending effort. In this way they were done some combination between the wood beams and the composite material. The wood beams were chosen from beach wood essence and had also different dimensions for length and section.

2. EXPERIMENTAL STUDY

The system of the wood beams are stick together with the help of the composite material and the epoxy matrix. We choose wood beams as much as possible without knots or cracks that could induce stress concentrators in the beams.

There are 7 beams, 2 unreinforced and 5 reinforced with composite material. The wood beams have the following dimensions 25x15x500mm (bxhxl).

The beams were reinforced using carbon fiber sheets in the middle of the package and glued by epoxy resin. The carbon fiber sheets has been cut at a width equal to 25 mm and the length of 500 mm according to the beams dimensions like we see in the figure from below:

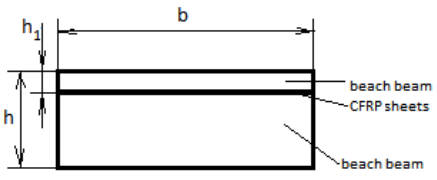

Fig 1. Reinforced beam

The package contain a beam of 25x10x500mm and a beam of 25x5x500mm (h_1=5mm) stick together with the epoxy matrix and the carbon fibers reinforcement. When the reinforced beams are realized we have to press uniformly the carbon sheets when is applied the epoxy matrix to get a very flat surface of the beams. For doing the mechanical tests on the beams it was done a device for these types of beams to determine which beams are more resistant than the unreinforced beams. The device is mounted on the universal machine utilized for testing the materials [4].

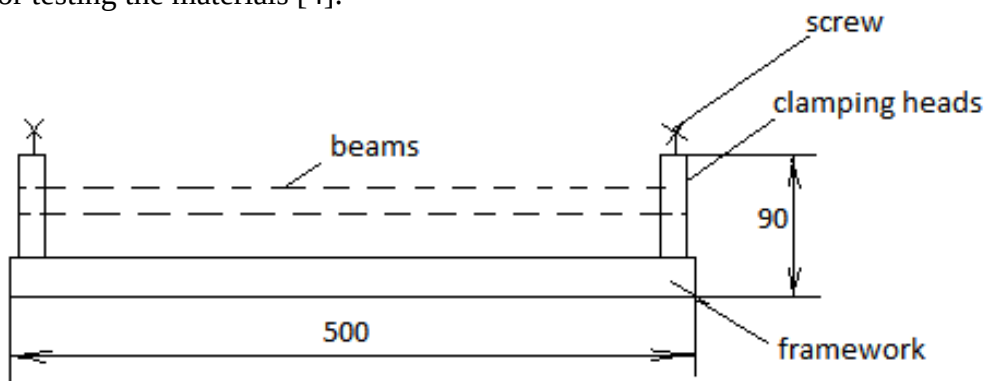

Fig 2. Device for testing the beams

After testing this type of reinforcement we can see that the beam situated on the bottom of the system it is first destroyed or cracked but not entirely (fig. 3). This is an important thing about this type of system because we can obtain important dates about the behavior of a real beam under the bending stress.

Fig 3. The beams after bending test

The results of the dependence between bending force and displacement for unreinforced beams are shown in the following graph:

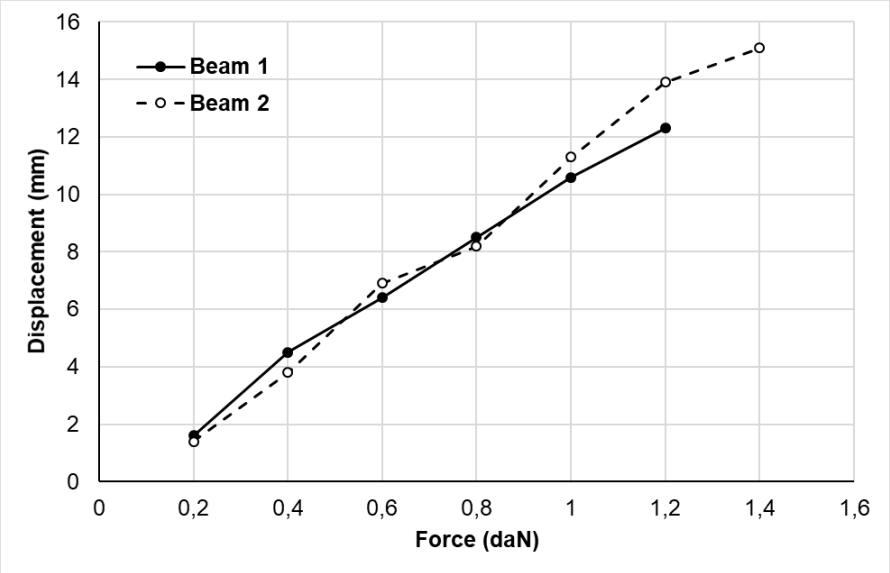

Fig.4 The dependence between bending force and displacement for unreinforced beams

It can be seen in the graph that the dependence between bending force and displacement for unreinforced beams has small differences because of the orientation of the wood fibers inside the beam.

The results of the displacements after the bending tests for the reinforced wood beams are shown in the following graph:

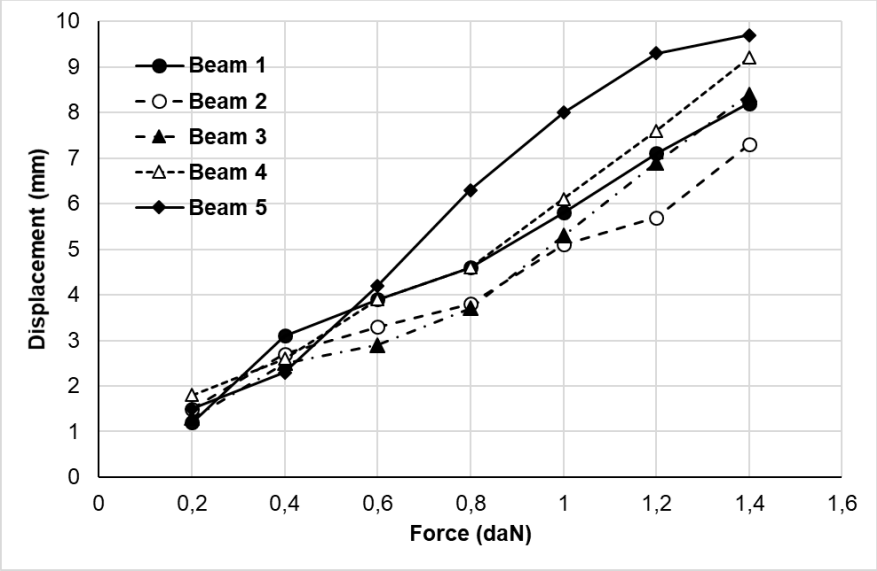

Fig. 5 The dependence between bending force and dispalcement for reinforced beams

From this results we can observe that the beam from below the package is the first which is broken. The beams have almost the same behavior on the bending test after that shows cracks of a few millimeters resisting more or less until the final brake.

This type of reinforcement can be easily destroyed after the maximum force but until then the beams don't crash instantly because of the composite material.

Two of the beams are unreinforced and the rest of five beams are reinforced. The two unreinforced beams are the first which are broken at a low force and at a big enough displacement.

For the five beams with composite materials reinforcement we can see that they are partially destroyed meaning that the CFRP allows the beams to withstand a high bending force before breaking completely.

The test reveals that the type of reinforcement give us information about the maximum displacement and maximum bending resistance of the tested system.

3. CONCLUSIONS

In this paper is presented an experimental bending study on reinforced beach beams with composite materials. The bending stress showed that the unreinforced beams are not enough resistant and they were first broken compared to the reinforced beams that resisted longer and had a lower displacement before totally broken. The tests on this kind of reinforcement reveal that the CFRP material is a good reinforcement and offer a good improvement of the mechanical properties of the beams helping to increase bending strength.

REFERENCES

[1] Pasăre M. M., Rezistenţa materialelor, îndrumar de laborator, Editura Academica Brâncuşi, Tg-Jiu, ISBN 978-973-144-419-2, 110 pg., 2011.

[2] Ionici C., Considerations on surface fatigue behavior of pm steel, 14TH GEOCONFERENCE SGEM CONFERENCE ON NANO, BIO TECHNOLOGIES, ISBN 978-619-7105-20-9 / ISSN 1314-2704 DOI:10.5593, No. 1, 134/137.

[3] Plevris N, Triantafillou T. FRP-reinforced wood as structural material. J Mater Civil Eng – ASCE 1992;4(3).

[4] Ianăşi C., Mitigation techniques of transverse displacement of the wood beams, Annals of the „Constantin Brâncuși" University of Târgu-Jiu, Engineering Series, Issue 4/2013, pp. 122-125, ISSN 1842-4856

[5] Ianăşi C., The behavior of the composite material used in reinforcement mechanism of the wood beams, Annals of the „Constantin Brâncuși" University of Târgu-Jiu, Engineering Series, Issue 4/2014, ISSN 1842-4856, pg. 137-140.