EXPERIMENTAL AND NUMERICAL CHARACTRIZATION OF COMPOSITE MATERIALS WITH LONG NATURAL JUTE FIBERS

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Abstract
This research aims to understand in more depth the mechanical behaviour of long natural jute fiber reinforced composites, utilising an equilibrate 0º/90º woven jute fiber fabric. The inherent variability of mechanical properties in natural materials has to be understood [1-3].

1 Introduction

This research aims to understand in more depth the mechanical behaviour of long natural jute fiber reinforced composites using both experimental and numerical methods. The inherent variability of mechanical properties in natural materials has to be understood and dealt with in experimental tests and numerical models have to be developed to simulate reliably these materials.

2 Mechanical characterization

A mechanical testing program with standard tension tests, bending and impact tests was performed using dry and not dry natural fibers, in polymeric matrices to assess the mechanical properties in the different conditions.

To limit the amount of experimental variables, woven jute fiber fabric is assessed together with an unsaturated polyester resin (AROPOL FS 6923), to produce composite plates by hand lay up process, and assessed together with an epoxy resin (SR 121 Sicomin) to performed a preimpregnated jute fibre fabric for production of composite plates in a hot plates press.

In the Figure 1 is show the Jute fiber woven fabric with a surface weight of $280 g/m^2$.

Figure 1 Jute fiber woven fabric

Composite plates produced by hand lay up process:
Plate PL01 - not dry Fibers (0º,0º,0º,0º), with 22% fibers weigth contents
Plate PL0S - dry Fibers (0º,0º,0º,0º), with 20% fibers weigth contents
Plate PL45N - not dry Fibers (-45º,+45º,+45º,-45º), with 22% fibers weigth contents
Plate PL45S - dry Fibers (-45º,+45º,+45º,-45º), with 20% fibers weigth contents

Composite plate produced utilizing a preimpregnated jute fibre fabric in a hot plates press:
Plate PLpreg - (0º,0º,0º,0º), with 51% fibers weigth contents

Typical tensile stress-strain curves of dry Jute fiber composites are show in Figure 2 whereas Tables 1-3 summarizes the results of mechanical characterization of the different composite plates produced.

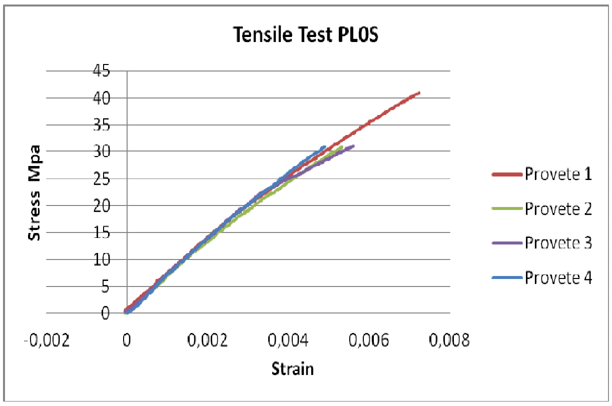

Figure 2 Tensile Test for dry Jute fiber composite

Plate	*E (MPa)*	*Max Stress (MPa)*
PL01	**6252,99**	**23,876**
PL0S	**6727,45**	**40,922**
PL45N	**4240,12**	**25,788**
PN45S	**4619,78**	**30,619**
Poyester Resin	**4175,92**	**61,476**
PLpreg	**9236,62**	**86,705**

Table 1 Tensile results (ASTM D3039) [4]

Plate	*E (MPa)*	*Max Stress (MPa)*	*Strain ε*	*Deflection (mm)*
PL01	**4760,94**	**70,121**	**0,02144**	**3,714**
PL0S	**5433,05**	**74,719**	**0,01895**	**2,978**
PL45N	**3715,63**	**55,881**	**0,02597**	**4,476**
PL45S	**4788,76**	**65,839**	**0,02091**	**3,642**

Table 2 Flexural results (three point bending, ASTM D790) [5]

Plate	*KJ/m2*
PL45N	**8,4187**
PL01	**7,4321**
Poyester Resin AROPOL FS 6923	**31,4986**

Table 3 Impact results (ISO 179) [6]

Conclusions

Is observed an increased of strength and stiffness to the heat treatment of drying the fibers.

The manufacture of prepregs jute fibre fabrics, allows the production of composite plates with a significantly higher percentage of fibers and a high gain in strength and stiffness properties.

References

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