Experimental study of the Influence of the shock on composite material plates "Laminated"

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Abstract:

Much has already bleu realized in the fast dynamic field that is expressed in our case by the impact load that is still relevant. Associated with the various difficulties of the request of shock the problems of study of composite materials in particular their homogenization or characterization comes to be added. In this objective our present investigation is interested under investigation of the influence of the impact on composite material plates. For an impaction with weight falling a used. The selected structure is laminated plates. The tests of characterization carried out then made it possible to supplement the data necessary to the various applications carried out. They got results are treated to be accessible.

Key words: Shock, Plate laminated, Deformation, Impaction with falling weight.

I. Introduction

The shock is a request which can arise in various forms and can have an intensity known or not. The effect of the shock can go from simple wave propagation to a total collapse of the structure. On their side the composite materials especially have a very important economic advantage in the fields of civil engineer and mechanics which enter like materials of reinforcement.

II. Composite material

The prone composite material of our study is a material which knows a broad use. Much that is realized work completed in the literature touch this field and clarify these uses [10].

II.1 the Laminated Material

A laminate consists of a stacking of folds having each one a clean orientation compared to a reference frame common to the layers and indicated like the reference frame of the laminate. The choice of stacking and more particularly of the orientations will make it possible to have specific mechanical properties.

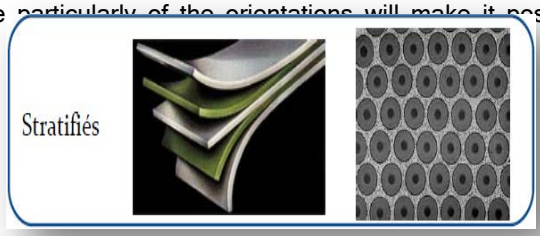

Figure1. Plate Laminated

II.2 Presentation of Material Used

The plates represented on figure 2 are manufactured out of composite materials. The folds three (03) consisted wood fibers are assembled by the resin. The three layers of fibers are directed of an angle of 45°.

Figure2. Plate Laminated

In the following Table one finds the various characteristics mechanical of the plate laminated:

Table1. Mechanical characteristic Plates Laminated and density

ρ= 1.87g/ cm3= 1870Kg/ m3

Composite material laminate	Results

YOUNG modulus (GPa)	9.44
Modulus of rigidity (GPa)	6.58
Poisson's ratio	-0.28

III. General information on the shock

In general, the shock is recognized as being the vibratory excitation, of which the duration is equal to approximately half of the clean period of the mechanical system. The force of excitation of the shock is defined as being the instantaneous acceleration transmitted to the structure at the point of application or the surface of contact. The answer of the system is expressed in terms of displacement relating to the base of the mass or the absolute acceleration of the mass.

IV. Definition of an impact

In mechanics, the shock corresponds to the application of an important force during a short time, generally accompanied by an abrupt shifting of speed. The impacts with strong energies often involve the perforation and thus seem to cause the damage the low registers. However, one should not neglect the impacts with weak energy because those cause laminations (separation) inside the composites which can be propagated under cyclic request. This phenomenon is insidious because no external sign prevents damage of the composite structure. In the case of an impact leading to the perforation of a plate in composite, one can compare the effect to that of a notch, i.e. with a reduction in the mechanical resistance from approximately 50%. [6, 7, 12]

V. Geometrical condition and in extreme cases

In Figure 2 one can see the data used in this example with knowing the geometrical characteristics of material, the effort of impact applied in Tableau2 table.

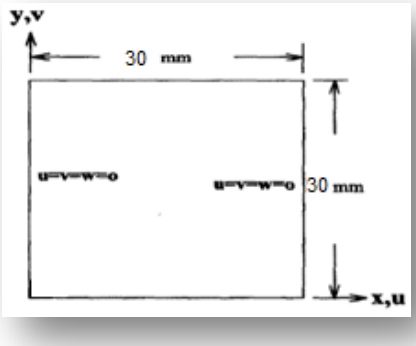

Figure3. Geometrical characteristic and condition of support.

The plate is embedded Bi as it is shown in this following photograph

Figure4. Boundary conditions of the plate

The mass of the carriage Impaction is

M = 29Kg, by varying the height of the carriage as it is indicated in table 2

Table 2: The load of application

Theoretical energy (J)	Theoretical speed (ms-1)	Height (m)	Traversed time (s)
85.347	2.42	**0.30**	0.72
284.49	4.42	**1**	1.48

VI. Realization of the test of impact

Initially, the installation of our plate laminated is held on the table of support by a fixing bi embedded using bite adjustable. The centering of the plate makes it possible to ensure the centering of the effort of the impact. Using the reducing gear actuator (with winch), one raises the carriage impaction of constant mass for all the tests with a given height h. The acquisition of the data being assured numerically then we present in what follows the tests with the results presented respectively the evolution of the displacement of the center of the plate according to time.

VII Results and discussed

- Test 1:

- the Height H = 0.30m

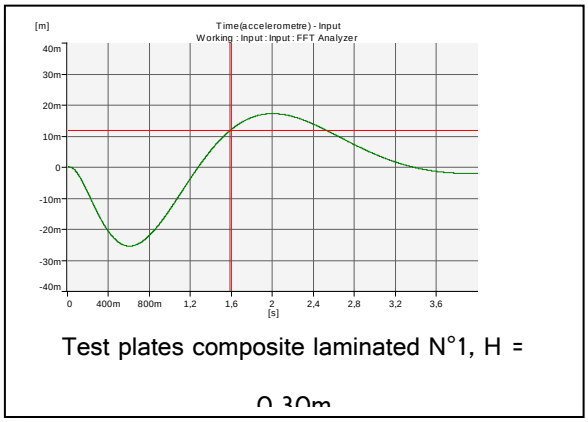

Figure5: Curve displacement/time

Results:

In this case we took a very small height. In spite of that we notice a case of rupture. We note that the deformation increases even with the reduction in energy.

- Test 2:
- the Height H = 1,00 m
- The section of the plate was doubled with a system of joining.

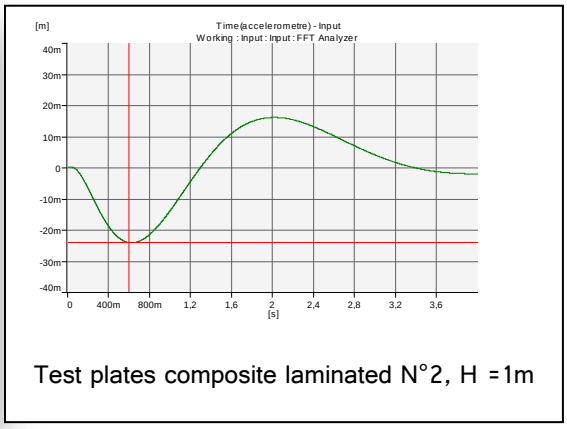

Figure6: Curve displacement/time.

In this case we took a height of 1m. We notice in this case that there are a cracking and a separation. There too we have a case of rupture.

VIII. Report of the deformations after

- Impact: (for various energies of impact).

- Preliminary tests:

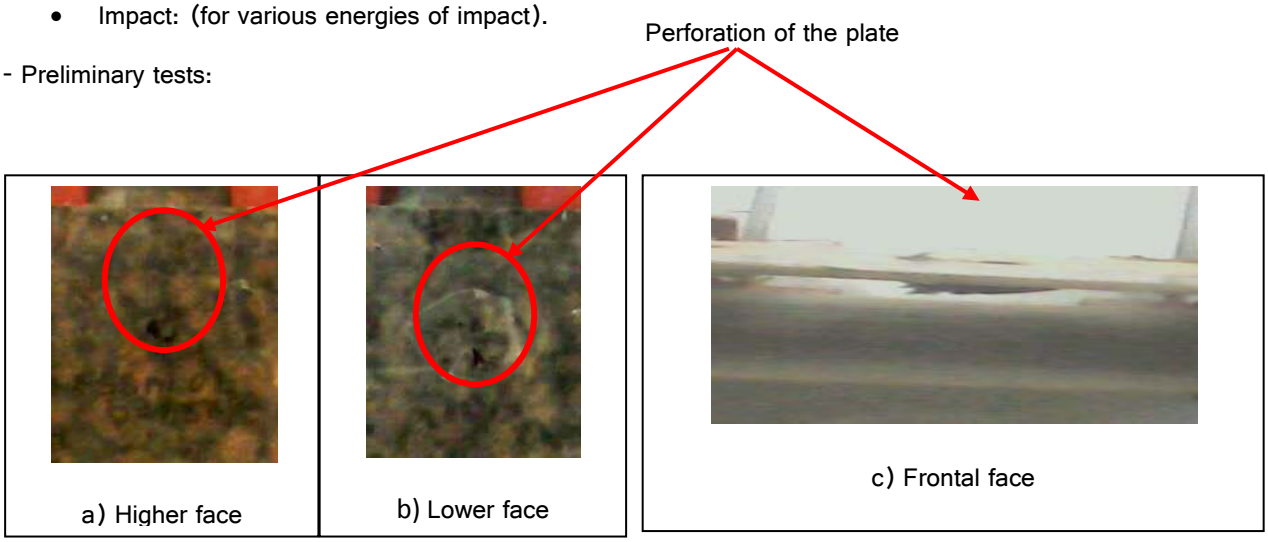

Figure7: Drop height 0,30m

The figure (c) of the frontal face shows the value of the displacement of the plate compare some with the thickness of the angle cracking of the plate and separation

Energy equalizes with 284.49j

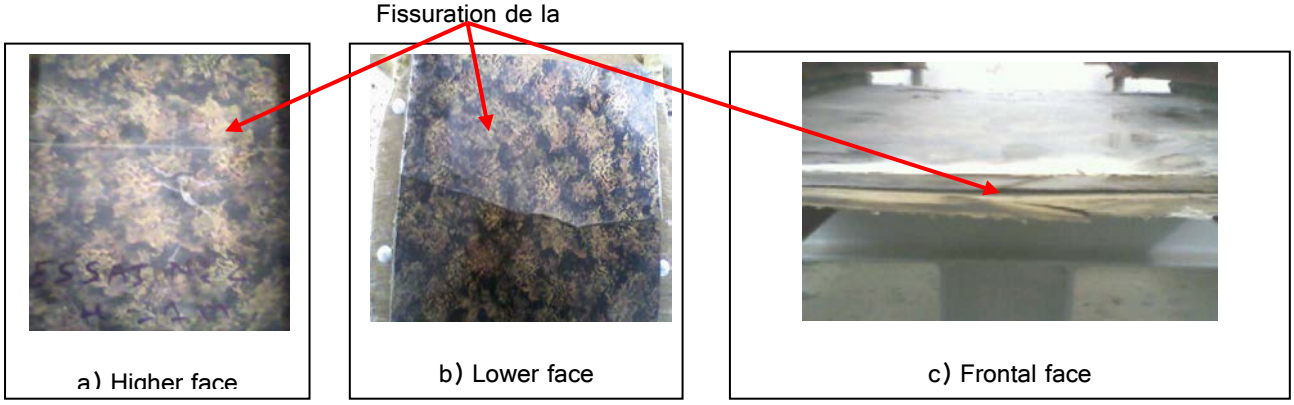

Figure8: A deformation at the time of the end of the impact

IX. Conclusion:

On the other hand the laminated plates which resist weak energies of impact can be used as one can note it in interior partitions or in carpentry the first test shows that after impact of the laminated plate there was a perforation, because the impaction struck the plate and finishes to push the plate to the bottom then there was a perforation within the limit of displacement of the plate downwards. Frontal face shows the value of the displacement of the plate compare some with the thickness of the angle.

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