# METHOD FOR PRODUCING AN ELEMENT IN A COMPOSITE MATERIAL

The present invention relates to a method for manufacturing an element in a composite material.

In the state of the art, a manufacturing method including a step for draping a fiber reinforcement, in a plurality of superposed layers is already known. The method also includes a step for providing resin in the fiber reinforcement. This step for providing resin may be prior to the draping step, notably in the case when a pre-impregnated fiber reinforcement is used, or subsequent to the draping step. The method subsequently includes a step for polymerizing the resin.

In certain cases, it is necessary to make an orifice in the manufactured composite element, for example in order to introduce therein an insert. This is notably the case within the scope of the manufacturing of tidal wave vanes, such vanes being generally attached on a composite element.

Such an orifice is generally made during a piercing step, subsequently to said polymerization step. Such a piercing step is relatively difficult to apply, notably because of problems of a technical, hardware and economical order, more particularly in the case of composite structures having a strong thickness. Indeed, the piercing of a composite element with a strong thickness requires particularly expensive specific tools. Thus, the step for piercing a composite element may represent up to 15% of the total cost of the manufacturing method for this composite element.

Embodiments of the invention seek to find a remedy to this drawback, by proposing a manufacturing method for an element in composite material, including at least one orifice made in a simple and economical way.

According to an aspect of the present invention, there is provided a method for manufacturing an element in a composite material, including:

- a step for draping a fiber reinforcement, in a plurality of superposed layers,
- a step for providing resin in the fiber reinforcement, prior or subsequently to the draping step, and
- a step for polymerizing the resin, wherein
- the method includes, prior to the draping step, a step for making cutouts with a predetermined shape in the fiber reinforcement,

- during the draping step, the layers of fiber reinforcement are superposed by putting the cutouts facing each other, the whole of the cutouts of the superposed layers forming at least a housing for an insert.

Embodiments of the invention propose to make cutouts in the fiber reinforcement before its draping. Such cutouts, made in a fiber reinforcement of a small thickness, are simple to make, and this without requiring any expensive tool.

During the method according to embodiments of the invention, the cutouts are superposed around an insert, the presence of which gives the possibility of ensuring that the resin provided in the fiber reinforcement does not flow into the orifice made by the superposition of the cutouts.

This insert may then be extracted from the manufactured element, or be kept in this element, for example for attaching a tidal turbine vane.

It should be noted that certain layers may be without any cutout, notably when the insert is longitudinal, the important point being that the cutouts form together a housing for the insert.

A manufacturing method according to embodiments of the invention may further include one or several of the following characteristics, taken alone or according to any technically conceivable combinations.

- The insert includes a transverse insert having a general cylindrical shape, extending substantially perpendicularly to the layers of fiber reinforcement.

- The manufacturing method includes, subsequently to the polymerization step, a step for extracting the transverse insert from its housing.

- The draping step being achieved by superposing the layers of fiber reinforcement in a mould, said transverse insert is laid out in the mould before the draping step, substantially perpendicularly to the layers of the fiber reinforcement, the draping step being made by passing each cutout around the transverse insert.

- The cutouts are dimensioned so as to receive the transverse insert surrounded by a pultruded tube and/or by a tubular fiber reinforcement.

- The transverse insert includes a tapped orifice, extending parallel to the layers of fiber reinforcement.

- The insert includes a longitudinal insert having a general cylindrical shape, notably as a threaded rod, extending parallel to the layers of fiber reinforcement.

- The draping step first of all includes the superposition of a plurality of layers without any cutouts for the longitudinal insert, the draping step is continued by superposition of a plurality of layers provided with cutouts for the longitudinal insert, the method includes an intermediate step for laying out the longitudinal insert in the cutouts

CLAIMS

1. A method for manufacturing an element in a composite material, including:

- a step for draping a fiber reinforcement, in a plurality of superposed layers,

- a step for providing resin in the fiber reinforcement, prior or subsequently to the draping step, and

- a step for polymerizing the resin, wherein

- the method includes, prior to the draping step, a step for making cutouts of a predetermined shape in the fiber reinforcement,

- during the draping step, the layers of fiber reinforcement are superposed by putting the cutouts facing each other, the whole of the cutouts of the superposed layers forming a housing at least for an insert.

2. The manufacturing method according to claim 1, wherein the insert includes a transverse insert having a general cylindrical shape, extending substantially perpendicularly to the layers of fiber reinforcement.

3. The manufacturing method according to claim 1 or 2, including, following the polymerization step, a step for extracting the transverse insert from its housing.

4. The manufacturing method according to claim 2 or 3, wherein, the draping step being achieved by superposing the layers of fiber reinforcement in a mould, said transverse insert is laid out in the mould prior to the draping step, substantially perpendicularly to the layers of fiber reinforcement, the draping step being achieved by having each cutout pass around the transverse insert.

5. The manufacturing method according to any of claims 2 to 4, wherein the cutouts are dimensioned for receiving the transverse insert surrounded by a pultruded tube and/or a tubular fiber reinforcement.

6. The manufacturing method according to any of claims 2 to 4, wherein the transverse insert includes a tapped orifice, extending parallel to the layers of fiber reinforcement.

7. The manufacturing method according to any of the preceding claims, wherein the insert includes a longitudinal insert having a general cylindrical shape, notably a threaded rod shape, extending parallel to the layers of fiber reinforcement.

8. The manufacturing method according to claim 7, wherein:

- the draping step first of all includes the superposition of a plurality of layers without any cutouts for the longitudinal insert,

- the draping step is continued by the superposition of a plurality of layers provided with cutouts for the longitudinal insert,

- the method includes an intermediate step for laying out the longitudinal insert in the cutouts of the layers provided with cutouts superposed beforehand,

- the draping step is continued, by the superposition of the whole of the layers provided with cutouts for the longitudinal insert, these cutouts being positioned around the longitudinal insert,

- the draping step is continued by the superposition of the remainder of layers without any cutouts.

9. The manufacturing method according to claim 8, wherein the draping step is achieved in a mould including a supporting element able to support a portion of the longitudinal insert from the intermediate layout step.

10. The manufacturing method according to claim 6 taken in combination with any of claims 7 to 9, wherein the insert includes a transverse insert provided with a tapped orifice , and a longitudinal insert assembled to the transverse insert by screwing into the tapped orifice, and wherein:

- the draping step first of all includes the superposition of a plurality of layers without any second cutouts for the longitudinal insert, but provided with first cutouts for the transverse insert,

- the draping step is continued by the superposition of a plurality of layers provided with second cutouts for the longitudinal insert and with first cutouts for the transverse insert,

- the method includes an intermediate step for laying out the assembled longitudinal and transverse inserts, into the corresponding cutouts of the layers superposed beforehand,

- the draping step is continued by the superposition of the whole of the layers provided with second cutouts for the longitudinal insert, these second cutouts being positioned around the longitudinal insert, and provided with first cutouts for the transverse insert, these first cutouts being positioned around the transverse insert ,

- the draping step is continued by the superposition of the remainder of layers without any second cutouts for the longitudinal insert and provided with first cutouts for the transverse insert, these first cutouts being positioned around the transverse insert.