A weave of composite material has a first weave and an X weave combined with the first weave. The X weave has multiple latitudinal fibers, multiple longitudinal fibers, and a woven center. Each longitudinal fiber is layered on two of the latitudinal fibers and then is woven through and layered under two of the latitudinal fibers. The longitudinal fibers are each woven by shifting in relative alignment position from one of the latitudinal fibers sequentially and woven radially with respect to a woven center, such that the longitudinal fibers form an X woven structure. Therefore, the intensity of the weave of composite material can be enhanced by the X weave with the X woven structure.
WEAVE OF COMPOSITE MATERIAL AND METHOD OF PREPARATION THEREOF

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a woven product, especially to a weave of composite material and method of preparation thereof.

[0003] 2. Description of Related Art

[0004] Generally, weave of composite material may be made of carbon fibers, glass fibers, aramid fibers, or other high toughness fibers, and include plain weave, unidirectional weave, or multidirectional weave. The weave of composite material is widely applied for the cases of portable electronic products to provide protection.

[0005] With reference to FIG. 5, a plain weave 50 comprises multiple longitudinal fibers 51 and multiple latitudinal fibers 52. The longitudinal fibers 51 and the latitudinal fibers 52 are interwoven mutually and perpendicularly to form a one-layer structure. The plain weave 50 has a low production cost, but the intensity of the plain weave 50 is low, such that multiple plain weaves 50 have to be stacked and combined with each other to maintain a high intensity. When multiple plain weaves 50 are stacked and combined with each other, warping easily occurs on the stacked plain weaves 50. The plain weave 50 is tightly woven, so an elasticity of the plain weave 50 is low, such that a stress concentration occurs easily when the plain weave 50 is forced with stress. When the stress concentration occurs, the woven structure of the plain weave 50 is easily damaged.

[0006] With reference to FIG. 6, a unidirectional weave 60 comprises multiple fibers 61. The fibers 61 are arranged and woven in the same direction to form a one-layer structure such that the intensity of the unidirectional weave 60 is low. Multi fixing lines 62 are mounted on the fibers 61 to fix the fibers 61 or the fibers 61 are impregnated with resins to reinforce the structure of the unidirectional weave 60. After reinforcement by the fixing lines 62 or resins, the intensity of the unidirectional weave 60 is still low, such that multiple unidirectional weaves 60 have to be stacked and combined with each other to maintain a high intensity. Nevertheless, warping easily occurs on the stacked unidirectional weaves 60.

[0007] With reference to FIG. 7, a multidirectional weave 70 comprises multiple first fibers 71 and multiple second fibers 72. The first fibers 71 and the second fibers 72 are stacked and woven at plus and minus 45 degrees or other angle degrees to form a two-layer structure. Multiple fixing lines 73 are mounted on the first fibers 71 and the second fibers 72 to fix the first fibers 71 and the second fibers 72. Warping hardly occurs on the multidirectional weave 70 because the first fibers 71 and the second fibers 72 are woven in multiple directions. Yet the drawback is, the multidirectional weave 70 has a high production cost.

[0008] Current market demands for a portable electronic product include low cost, slim thickness, and high intensity. The costs of the plain weave 50 and the unidirectional weave 60 are low respectively, and the stacked plain weaves 50 and the stacked unidirectional weaves 60 both have high intensity. However, warping easily appears on the stacked plain weaves 50 and the stack unidirectional weaves 60. The stacked plain weaves 50 and the stacked unidirectional weaves 60 have large thickness, such that adjusting the thickness to meet the demand of slimmer for the portable electronic product is difficult. On the other hand, when the plain weave 50 is forced with stress, the stress concentration of the plain weave 50 leads to structural damage easily. The multidirectional weave 70 has little warping, but the cost of the multidirectional weave 70 is high. Therefore, the plain weave 50, the unidirectional weave 60, and the multidirectional weave 70 are all inadequate to meet the current demand for the portable electronic product.

SUMMARY OF THE INVENTION

[0009] The main object of the present invention is to provide a weave of composite material and a method of preparing the weave.

[0010] The weave of composite material in accordance with the present invention comprises a first weave and an X weave.

[0011] The first weave has two sides.

[0012] The X weave is combined with the first weave and has two sides, multiple first-direction regions, multiple second-direction regions, multiple latitudinal fibers, multiple longitudinal fibers, and at least one woven center. One of the sides of the X weave is combined with one of the sides of the first weave. The second-direction regions are arranged intertwined with the first-direction regions. The latitudinal fibers are arranged in a horizontal direction, and the longitudinal fibers are arranged in a longitudinal direction relative to the latitudinal fibers. The at least one woven center is joined between the first-direction regions and the second-direction regions.

[0013] Each longitudinal fiber is layered on at least two of the latitudinal fibers and then is woven through and layered under at least two of the latitudinal fibers. The longitudinal fibers are each woven by shifting in relative alignment position from at least one of the latitudinal fibers sequentially, and are woven radially with respect to the at least one woven center.

[0014] The method of preparing the weave of composite material comprises preparing a first weave and an X weave, and combining the first weave and the X weave.

[0015] The X weave is woven arranging each longitudinal fiber, skipping at least two latitudinal fibers sequentially, to be layered under and on the latitudinal fibers, and the longitudinal fibers are each shifted in relative alignment position from at least one latitudinal fiber respectively and sequentially to form an X woven structure with respect to a woven center.

[0016] The first weave is applied as a base for the X weave. The longitudinal fibers are woven radially with respect to the woven center, such that the elasticity of the X weave can be enhanced by the X woven structure and the woven center. Stress concentration and the warping thus hardly appear on the weave. The intensity of the weave is enhanced, such that the weave does not need to be layered with another weave to increase the intensity. The weave are woven by controlling the longitudinal fibers, such that the manufacturing cost of the weave is relatively low. Therefore, the weave can meet the demands for the portable electronic products easily.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is an exploded perspective view of a first preferred embodiment of a weave of composite material in accordance with the present invention.

[0018] FIG. 2 is an enlarged front view of the weave of composite material in FIG. 1.
FIG. 3 is a woven diagram of the X weave of the weave of composite material in FIG. 1; FIG. 4 is an exploded perspective view of a second preferred embodiment of a weave of composite material in accordance with the present invention; FIG. 5 is an exploded perspective view of two conventional stacked plain weaves; FIG. 6 is an exploded perspective view of two conventional stacked unidirectional weaves; and FIG. 7 is a perspective view of a conventional multidirectional weave.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

With reference to FIG. 1, a first preferred embodiment of a weave of composite material in accordance with the present invention has a first weave 10, an X weave 20, and a second weave 30.

The first weave 10 and the second weave 30 can be plain woven or unidirectionally woven. The X weave 20 is composed between the first weave 10 and the second weave 30 by interweaving the first weave 10, the X weave 20 and the second weave 30 with resin and then aging the resin. Alternatively, multiple X weaves 20 can be combined between the first weave 10 and the second weave 30, depending on the intensity demand for the weave of composite material. The first weave 10 and the second weave 30 are applied as combined bases for the X weave 20. Alternatively, the second weave 30 may be omitted, and only the first weave 10 is applied as the combined base for the X weave 20.

With reference to FIG. 2 and FIG. 3, the X weave 20 comprises two first-direction regions 21, two second-direction regions 22, multiple longitudinal fibers 23, and multiple longitudinal fibers 24. The first-direction regions 21 and the second-direction regions 22 are arranged intertwined with each other like a checkerboard, which means that the first-direction regions 21 are located in the upper left region and the lower right region in FIG. 2 respectively, and the second-direction regions 22 are located in the upper right region and the lower left region in FIG. 2 respectively. The longitudinal fibers 23 are arranged horizontally. The longitudinal fibers 24 are arranged longitudinally.

Each longitudinal fiber 24 located in the first-direction region 21 is layered on two of the latitudinal fibers 23 and then is woven through and layered under two of the latitudinal fibers 23 to be inter-layered with the latitudinal fibers 23. The longitudinal fibers 24 are each woven by shifting in relative alignment position from one of the latitudinal fibers 23 sequentially such that the longitudinal fibers 24 form a pattern inclining from the upper left portion to the lower right portion in the first-direction regions 21.

Each longitudinal fiber 24 located in the second-direction regions 22 is layered on two of the latitudinal fibers 23 and then is woven through and layered under two of the latitudinal fibers 23 to be inter-layered with the latitudinal fibers 23. The longitudinal fibers 24 are each woven by shifting in relative alignment position from one of the latitudinal fibers 23 sequentially such that the longitudinal fibers 24 form a pattern inclining from the upper right portion to the lower left portion in the second-direction regions 22. Therefore, the first-direction regions 21 and the second-direction regions 22 form an X-shaped woven structure, and then a woven center 25 is formed at the junction of the first-direction regions 21 and the second-direction regions 22.

Each longitudinal fiber 24 and each latitudinal fiber 23 may be made of carbon fibers, glass fibers, aramid fibers, or other high toughness fibers, such that the X weave 20 can be customized according to different intensity demands.

The longitudinal fibers 24 are woven longitudinally and the latitudinal fibers 23 are woven horizontally relatively to the longitudinal fibers 24, such that the structure of the X weave 20 is compact and reinforced. The longitudinal fibers 24 and the latitudinal fibers 23 are woven radially with respect to the woven center 25 to form an X-shape. Woven to form four different directions with respect to the woven center 25, the X weave 20 as well as the woven center 25 can both have enhanced intensity and elasticity. As a result, stress concentration and warping hardly occur on the weave of composite material of the present invention.

Because the intensity of the X weave 20 is higher than the intensity of the conventional plain weave and the intensity of the conventional unidirectional weave, the X weave 20 can achieve the same level of intensity with multiple conventional combined plain weaves and multiple conventional combined unidirectional weaves. The weave of composite material of the present invention has a slim thickness, and when the weave of composite material is applied on a portable electronic product, the total thickness of the weave and the electronic product is adjusted easily. On the other hand, the X weave 20 is woven by controlling the longitudinal fibers 24 by a weaving board, such that the manufacturing cost of the weave of composite material of the present invention is lower than the manufacturing cost of the conventional multidirectional weave. The X weave 20 can be woven by using different fibers to meet different demands for different customers.

The method of preparing the weave of composite material comprises: preparing a first weave, an X weave, and a second weave, and then combining the X weave between the first weave and the second weave.

The X weave is woven by arranging each longitudinal fiber, skipping two latitudinal fibers sequentially, to be layered under and on the multiple latitudinal fibers. The longitudinal fibers are each shifted in relative alignment position from a latitudinal fiber respectively and sequentially to form an X woven structure with a woven center.

Alternatively, the method of preparation may comprise combining multiple X weaves between the first weave and the second weave. Alternatively, the second weave may be omitted, and the method of preparation comprises preparing the first weave and the X weave, and then combining the first weave and the X weave.

With reference to FIG. 4, an X weave 20A is combined between the first weave 10 and the second weave 30 of a second preferred embodiment of the weave of composite material of the present invention. The X weave 20A comprises eight first-direction regions 21, eight second-direction regions 22, multiple latitudinal fibers 23, and multiple longitudinal fibers 24. The means of weaving the X weave 20A of the second preferred embodiment is same as weaving the X weave 20 of the first preferred embodiment. The first-direction regions 21 and the second-direction regions 22 are arranged intertwined with each other, such that five woven centers 25 are formed at the junctions of the corresponding first-direction regions 21 and the second-direction regions 22, corresponding to each other in position. The longitudinal fibers 24 form five X structures with respect to the five woven
centers 25 respectively, such that the intensity of the X weave 20A can be enhanced by the woven centers 25 and the X structures.

What is claimed is:

1. A weave of composite material comprising:
   a first weave having two sides; and
   an X weave combined with the first weave and having two sides, wherein one of the sides of the X weave is combined with one of the sides of the first weave;
   multiple first-direction regions;
   multiple second-direction regions arranged intertwined with the first-direction regions;
   multiple latitudinal fibers arranged adjacent to the horizontal direction;
   multiple longitudinal fibers arranged adjacent to the longitudinal direction relative to the latitudinal fibers; and
   at least one woven center joined between the first-direction regions and the second-direction regions;

2. The weave of composite material as claimed in claim 1, wherein a second weave is combined with the side of the X weave that is opposite to the first weave.

3. The weave of composite material as claimed in claim 2, wherein the longitudinal fibers and the latitudinal fibers are made of carbon fibers, glass fibers, or aramid fibers.

4. The weave of composite material as claimed in claim 3, wherein the X weave has two first-direction regions, two second-direction regions, and a woven center.

5. The weave of composite material as claimed in claim 3, wherein the X weave has eight first-direction regions, eight second-direction regions, and five woven centers.

6. The weave of composite material as claimed in claim 1, wherein each longitudinal fiber is layered on two of the latitudinal fibers and then is woven through and layered under two of the latitudinal fibers, and the longitudinal fibers are woven radially with respect to the woven center.

7. The weave of composite material as claimed in claim 2, wherein each longitudinal fiber is layered on two of the latitudinal fibers and then is woven through and layered under two of the latitudinal fibers, and the longitudinal fibers are woven radially with respect to the woven center.

8. The weave of composite material as claimed in claim 3, wherein each longitudinal fiber is layered on two of the latitudinal fibers and then is woven through and layered under two of the latitudinal fibers, and the longitudinal fibers are woven radially with respect to the woven center.

9. The weave of composite material as claimed in claim 4, wherein each longitudinal fiber is layered on two of the latitudinal fibers and then is woven through and layered under two of the latitudinal fibers, and the longitudinal fibers are woven radially with respect to the woven center.

10. The weave of composite material as claimed in claim 5, wherein each longitudinal fiber is layered on two of the latitudinal fibers and then is woven through and layered under two of the latitudinal fibers, and the longitudinal fibers are woven radially with respect to the woven center.

11. A method of preparing the weave of composite material as claimed in claim 1 comprising:
   preparing a first weave and an X weave; and
   combining the first weave and the X weave, wherein
   the X weave is woven arranging each longitudinal fiber, skipping at least two latitudinal fibers sequentially, to be layered under and on the latitudinal fibers, and the longitudinal fibers are each shifted in relative alignment position from at least one latitudinal fiber respectively and sequentially to form an X woven structure with respect to a woven center.

12. The method of preparing the weave of composite material as claimed in claim 11, further comprising:
   preparing a second weave, and
   combining the second weave and the X weave to locate the X weave between the first weave and the second weave.

13. The method of preparing the weave of composite material as claimed in claim 12, wherein each latitudinal fiber and each longitudinal fiber are made of carbon fibers, glass fibers, or aramid fibers.

14. The method of preparing the weave of composite material as claimed in claim 11, wherein the X weave is woven arranging each longitudinal fiber, skipping two latitudinal fibers sequentially, to be layered under and on the latitudinal fibers, and the longitudinal fibers are each shifted in relative alignment position from a latitudinal fiber respectively and sequentially.

15. The method of preparing the weave of composite material as claimed in claim 12, wherein the X weave is woven arranging each longitudinal fiber, skipping two latitudinal fibers sequentially, to be layered under and on the latitudinal fibers, and the longitudinal fibers are each shifted in relative alignment position from a latitudinal fiber respectively and sequentially.

16. The method of preparing the weave of composite material as claimed in claim 13, wherein the X weave is woven arranging each longitudinal fiber, skipping two latitudinal fibers sequentially, to be layered under and on the latitudinal fibers, and the longitudinal fibers are each shifted in relative alignment position from a latitudinal fiber respectively and sequentially.

* * * * *