CLAIMS

1. A component made of a fibre composite material which comprises at least three wound layers (20a, 20b, 20c, 20d) made of a fibre material that are arranged one over the other, wherein

   - each of the wound layers (20a, 20b, 20c, 20d) comprises one or more windings (23), wherein for each wound layer (20a, 20b, 20c, 20d) comprising more than one winding (23), all windings (23) of said wound layer (20a, 20b, 20c, 20d) have the same winding angle (β) and are separated from each other at least in some sections to form intermediate spaces (25) between the windings (23),

   - all windings (23) of at least two of the wound layers (20a, 20c) have the same first winding angle (β) and

   - all of the one or more windings (23) of at least one wound layer (20b), which is arranged between the at least two wound layers (20a, 20c) having the windings (23) having a same first winding angle (β), have a second winding angle (γ), wherein the magnitude of the second winding angle (γ) is different from the magnitude of the first winding angle (β), and wherein at least one of the windings (23) having the second winding angle (γ) intersects with at least one of the windings (23) having the first winding angle (β).

2. The component according to claim 1, characterised in that the complete winding formed from all the wound layers (20a, 20b, 20c, 20d) arranged one above the other is free from intermediate spaces in plan view.

3. The component according to claim 1 or 2, characterised in that in each wound layer (20a, 20b, 20c, 20d) which comprises more than one winding (23), the ratio of the sum of the areas of the intermediate spaces (25) between the windings (23) in the wound layer (20a, 20b, 20c, 20d) to the total area of the wound layer (20a, 20b, 20c, 20d) is 0.05000 to 0.99999, preferably 0.90000 to 0.99999, particularly preferably 0.99000 to 0.99999 and quite particularly preferably is 0.99990 to 0.99999.

4. The component according to at least one of the preceding claims, characterised in that the winding angles (β) of all the windings (23) within a wound layer (20a, 20b, 20c, 20d) differ from one another by less than 1°, preferably by at most 0.8°, particularly preferably by at most 0.5° and quite particularly preferably by at most 0.2°.

5. The component according to at least one of the preceding claims, characterised in that the magnitude of the second winding angle (γ) differs from the magnitude of the first winding angle (β) by at least 1°.

6. The component according to at least one of the preceding claims, characterised in that at least one winding (23) of at least one of the wound layers (20a, 20b, 20c, 20d) at least in some sections engages in at least one intermediate space (25) of a wound layer (20a, 20b, 20c, 20d) arranged below and/or above the wound layer.

7. The component according to claim 6, characterised in that all the windings (23) of at least one of the wound layers (20a) having the windings (23) having the

first winding angle (β) engage in the intermediate spaces (25) of the at least one wound layer (20b) having the at least one winding (23) having the second winding angle (γ) and/or in the intermediate spaces (25) of the further wound layer (20c) having the windings (23) having the first winding angle (β).

8. The component according to at least one of the preceding claims, characterised in that each of the wound layers (20a, 20b, 20c, 20d) comprises 1 to 2,000, preferably 1 to 250, particularly preferably 1 to 150 and quite particularly preferably 1 to 10 windings (23).

9. The component according to at least one of the preceding claims, characterised in that the component comprises at least 10, preferably 200 to 10,000, particularly preferably 500 to 10,000 and quite particularly preferably 2,000 to 5,000 wound layers (20a, 20b, 20c, 20d) arranged one above the other.

10. The component according to at least one of the preceding claims, characterised in that in each case one wound layer (20a, 20c) having the windings (23) having the first winding angle (β) and one wound layer (20b, 20d) having the windings (23) having the second winding angle (γ) are arranged directly above one another in alternating sequence.

11. The component according to at least one of claims 1 to 9, characterised in that at least one additional wound layer is arranged between the at least two wound layers (20a, 20c) having the windings (23) having the first winding angle (β) apart from the wound layer (20b) having the windings (23) having the second winding angle (γ).

12. The component according to claim 11, characterised in that the at least one additional wound layer comprises one or more windings (23), wherein all these windings have a third winding angle (δ) whose magnitude differs from the magnitude of the first winding angle (β) and from the magnitude of the second winding angle (γ).

13. The component according to at least one of the preceding claims, characterised in that all the windings (23) having the second winding angle (γ) intersect with at least one winding (23) having the first winding angle (β).

14. The component according to at least one of the preceding claims, characterised in that the fibres are selected from the group which consists of carbon fibres, ceramic fibres, glass fibres, polymer fibres and mixture of two or more of the aforesaid materials, wherein the polymer fibres are preferably polyamide fibres, in particular aramid fibres, polyester fibres, polypropylene fibres, polyacrylonitrile fibres, fibres of oxidised polyacrylonitrile and fibres of copolymers of two or more of the aforesaid materials and mixtures of two or more of the aforesaid materials.

15. The component according to at least one of the preceding claims, characterised in that fibre composite material is a carbon-fibre-reinforced carbon (CFC), a carbon-fibre-reinforced plastic (CFP), a carbon-fibre-reinforced ceramic or a ceramic-fibre-reinforced ceramic (CMC).

16. The component according to at least one of the preceding claims, characterised in that the wound layers (20a, 20b, 20c, 20d) arranged one above the other form an unsupported winding.

17. The component according to at least one of the preceding claims, characterised in that the component is configured as a crucible for the melting and crystallisation of a metal and/or semi-metal.

18. Method for fabricating a component made of a fibre composite material, in particular a component according to one of the preceding claims, in which at least three wound layers (20a, 20b, 20c, 20d) of a fibre material are wound on a winding core (11), wherein:

- for each of the wound layers (20a, 20b, 20c, 20d) one or more windings (23) are wound, wherein all the windings (23) of one wound layer (20a, 20b, 20c, 20d) which has more than one winding (23), are wound with the same winding angle (β) and are separated from each other onto the winding core (11) at least in some sections to form intermediate spaces (25) between the windings (25),

- the windings (23) of at least two of the wound layers (20a, 20c) having the same first winding angle (β) are wound on the winding core (11) and

- all of the one or more windings (23) of at least one wound layer (20b) having a second winding angle (γ), whose magnitude differs from the magnitude of the first winding angle (β) are wound on the winding core (11) in such a manner that this wound layer (20b) is arranged between the at least two wound layers (20a, 20c) having the windings (23) having the first winding angle (β) and at least one of the windings (23) having the second winding angle (γ) intersects with at

least one of the windings (23) having the first winding angle (β).

19. The method according to claim 18, characterised in that the windings (23) of the at least three wound layers (20a, 20b, 20c, 20d) are wound on the winding core (11) in such a manner that they completely cover at least a section of the winding core (11).

20. The method according to claim 18 or 19, characterised in that for each wound layer (20a, 20b, 20c, 20d) at least two windings (23) of the fibre material are wound on the winding core (11) separated from one another at least in some sections to form intermediate spaces (25) between the windings so that the ratio of the sum of the areas of the intermediate spaces between the windings (23) in the wound layer (20a, 20b, 20c, 20d) to the total area of the wound layer (20a, 20b, 20c, 20d) is 0.05000 to 0.99999, preferably 0.90000 to 0.99999, particularly preferably 0.99000 to 0.99999 and quite particularly preferably is 0.99990 to 0.99999.

21. The method according to at least one of claims 18 to 20, characterised by the further steps:

- impregnating the fibre material before, during or after the winding with binder and

- curing the binder after the impregnating and after the winding of the fibre material.

22. The method according to claim 21, characterised in that the curing takes place thermally and/or chemically.

23. The method according to at least one of claims 18 to 22, characterised in that for the winding endless fibre strands (17) containing carbon fibres are laid on the winding core (11).

24. The method according to at least one of claims 18 to 23, characterised in that before the winding of the wound layers (20a, 20b, 20c, 20d) on the winding core (11) a program is created and/or configured which contains control instructions relating to the winding for an automatic winding machine, wherein the winding of the windings (23) is accomplished by executing the control instructions.

CLAIMS

1. A component comprising a fibre composite material and having at least three wound layers (20a, 20b, 20c, 20d) comprising a fibre material and arranged one above another, characterised in that:

   - the wound layers (20a, 20b, 20c, 20d) have one or more windings (23), wherein in each wound layer (20a, 20b, 20c, 20d) having more than one winding (23), all the windings (23) of said wound layer (20a, 20b, 20c, 20d) have the same winding angle and are separated from each other in at least one portion, whereby gaps (25) are formed between the windings,

   - all the windings of at least two of the wound layers (20a, 20c) have an identical first winding angle (β), and

   - all of the one or more windings (23) of at least one wound layer (20b), which is arranged between the at least two wound layers (20a, 20c) having the windings (23) having the same first winding angle (β), have a second winding angle (γ), wherein the magnitude of the second winding angle (γ) is different from the magnitude of the first winding angle (β), and wherein at least one of the windings (23) having the second winding angle (γ) intersects with at least one of the windings (23) having the first winding angle (β), and at least one winding (23) of at least one of the wound layers (20a, 20b, 20c, 20d) engages, in at least one portion, in at least one gap (25) of a wound layer (20a, 20b, 20c, 20d) arranged above and/or below that wound layer.

2. The component according to claim 1, characterised in that the overall wound body formed from all the wound layers (20a, 20b, 20c, 20d) arranged one above another has no gaps when seen from above.

3. The component according to claim 1 or 2, characterised in that in each wound layer (20a, 20b, 20c, 20d) having more than one winding (23), the ratio of the sum of the areas of the gaps (25) between the windings (23) in the wound layer (20a, 20b, 20c, 20d) to the total area of the wound layer (20a, 20b, 20c, 20d) is from 0.05000 to 0.99999.

4. The component according to at least one of the preceding claims, characterised in that the winding angles (β) of all the windings (23) within a single wound layer (20a, 20b, 20c, 20d) differ from one another by less than 1°.

5. The component according to at least one of the preceding claims, characterised in that the magnitude of the second winding angle (γ) differs from the magnitude of the first winding angle (β) by at least 1°.

6. The component according to at least one of the preceding claims, characterised in that all the windings (23) of at least one of the wound layers (20a) having windings having the first winding angle (β) engage in the gaps in a wound layer (20b) having at least one winding (23) having the second winding angle (γ), and/or in the gaps in a further wound layer (20c) having windings (23) having the first winding angle (β).

7. The component according to at least one of the preceding claims, characterised in that each of the wound layers (20a, 20b, 20c, 20d) has from 1 to 2,000 windings (23).

8. The component according to at least one of the preceding claims, characterised in that the component has up to at least 10 wound layers (20a, 20b, 20c, 20d) arranged one above another.

9. The component according to at least one of the preceding claims, characterised in that each wound layer (20a, 20c) having the windings (23) having the first winding angle (β), and wound layers (20c, 20d) having the windings (23) having the second winding angle (γ), are arranged alternately and directly above one another.

10. The component according to at least one of claims 1 to 8, characterised in that at least one additional wound layer is arranged between the at least two wound layers (20a, 20c) having the windings (23) having the first winding angle (β), in addition to the wound layer (20b) having the windings (23) having the second winding angle (γ).

11. The component according to claim 10, characterised in that the at least one additional wound layer has one or more windings (23), wherein all these windings have a third winding angle (δ) whose magnitude differs from the magnitude of the first winding angle (β) and from the magnitude of the second winding angle (γ).

12. The component according to at least one of the preceding claims, characterised in that all the windings (23) having the second winding angle (γ)

intersect with at least one winding (23) having the first winding angle (β).

13. The component according to at least one of the preceding claims, characterised in that the fibres are selected from the group comprising carbon fibres, ceramic fibres, glass fibres, polymer fibres and mixtures of two or more of the aforesaid materials, wherein the polymer fibres are polyamide fibres, aramid fibres, polyester fibres, polypropylene fibres, polyacrylonitrile fibres, fibres comprising oxidised polyacrylonitrile, fibres comprising copolymers of two or more of the aforesaid materials, and fibres comprising mixtures of two or more of the aforesaid materials.

14. The component according to at least one of the preceding claims, characterised in that the fibre composite material is a carbon-fibre-reinforced carbon (CFC), a carbon-fibre-reinforced synthetic resin (CFK), a carbon-fibre-reinforced ceramic or a ceramic-fibre-reinforced ceramic (CMC).

15. The component according to at least one of the preceding claims, characterised in that the wound layers (20a, 20b, 20c, 20d) arranged one above another form an unsupported wound body.

16. The component according to at least one of the preceding claims, characterised in that the component is formed as a crucible for the melting and crystallisation of a metal and/or a semi-metal.

17. A method for fabricating a component comprising a fibre composite material, in which fabrication method at least three wound layers (20a, 20b, 20c, 20d)

comprising a fibre material are wound on a winding core (11), said method of fabricating a component being characterised in that:

- in each of the at least three wound layers (20a, 20b, 20c, 20d) one or more windings (23) are wound, wherein all the windings (23) of a wound layer (20a, 20b, 20c, 20d) which has more than one winding (23) are wound onto the winding core (11) with the same winding angle (β) and separated from each other in at least one portion to form gaps (25) between the windings (23),

- the windings (23) of at least two wound layers (20a, 20c) are wound on the winding core (11) with a same first winding angle (β), and

- all of the one or more windings (23) of at least one wound layer (20b) that have a second winding angle (γ) whose magnitude differs from the magnitude of the first winding angle (β), are wound on the winding core (11) in such a manner that this wound layer (20b) is arranged between the at least two wound layers (20a, 20c) having windings (23) having the first winding angle (β), and in such manner that at least one of the windings (23) having the second winding angle (γ) intersects with at least one of the windings (23) having the first winding angle (β); and so that in this case, at least one winding (23) of at least one winding layer (20a, 20b, 20c, 20d) engages, in at least one portion, in at least one gap (25) of a winding layer (20a, 20b, 20c, 20d) arranged above and/or below that winding layer.

18. The method of fabricating a component according to claim 17, characterised in that the windings (23) of the at least three wound layers (20a, 20b, 20c, 20d) are wound on the winding core (11) in such a manner that they completely cover at least a portion of the winding core (11).

19. The method of fabricating a component according to claim 17 or 18, characterised in that each wound layer (20a, 20b, 20c, 20d) is wound on the winding core (11) in such manner that the ratio of the sum of the areas of the gaps between the windings (23) in a wound layer (20a, 20b, 20c, 20d) to the total area of the wound layer (20a, 20b, 20c, 20d) is from 0.05000 to 0.99999; and in such manner that at least two windings (23) of the fibre material are separated from one another in at least one portion, whereby a gap (25) is formed between the windings (23).

20. The method of fabricating a component according to at least one of claims 17 to 19, characterised in having further processing steps of:

- impregnating the fibre material with a binder before, during or after the winding process, and

- curing the binder after the impregnating and the winding of the fibre material.

21. The method of fabricating a component according to claim 20, characterised in that the curing is carried out thermally and/or chemically.

22. The method of fabricating a component according to at least one of claims 17 to 21, characterised in that for the winding process, endless fibre strands (17)

containing carbon fibres are laid on the winding core (11).

23. The method of fabricating a component according to at least one of claims 17 to 22, characterised in that a program is created or configured before winding the wound layers (20a, 20b, 20c, 20d) on the winding core (11), this program containing control commands for an automatic winding machine and that relate to the winding process, wherein the winding of the windings (23) is accomplished by executing the control commands.