DOUBLE SHEET ALUMINUM PANEL AND METHOD FOR MANUFACTURE THEREOF

Description

The present invention relates to a double sheet aluminum panel, ~~according to the subject-matter of independent claim 1.~~ Furthermore, the invention provides a method for manufacturing such a double sheet aluminum panel.

Due to their exceptional mechanical properties, composite panels have a wide variety of application such as aircraft construction or architecture. In architecture, for instance, composite panels are used for external walls, shop awnings, signage and ceilings. Depending on their composition, composite panels can exhibit many advantageous features such as being weather proof, noise absorbing, fireproof, light and easy to cut, impact resistant and easy to maintain. Composite panels are also known as sandwich elements, as they commonly consist of a plurality of different layers arranged on top of each other. In many cases, composite panels exhibit at least three layers, in particular a core layer as well as two outer layers attached to either side of the core.

Above all, aluminum composite panels are utilized in architectural applications, such as the cladding of buildings. Although, aluminum composite panels are exceedingly light weight, they exhibit high durability and are easy to process. In consequence of their application in hospitals, tunnels and stadiums, however, there is a need for composite panels which are incombustible. This requirement is specified within the European-standard EN 13501-1. Depending on properties like

On the basis of the problems outlined above, ~~it is an object of~~embodiments of the present invention seek to provide a non-combustible aluminum panel, fulfilling the European, German and French standard, which is easy to produce and exhibits a flexibility, which is capable of absorbing the deformations resulting from mechanical stresses of the cover layers. Furthermore, ~~it is an objective~~ embodiments of the present invention seek to provide an aluminum panel, which is particularly easy to handle.

To this end, ~~the invention relates to~~ there is disclosed a double sheet aluminum panel, which consists of two aluminum layers attached to each other by means of an adhesive layer disposed there between. ~~In more detail, the~~ A double sheet aluminum panel according to an aspect of the present invention consists of a first layer of a first aluminum material attached to a second layer of a second aluminum material. The first and second layers are attached to each other by means of an adhesive layer disposed between the first and second layers.

In other words, the panel according to the present invention does not comprise a particular core layer comprising organic and/or inorganic ingredients in order to provide non-flammability of the aluminum sheet panel. Rather, it was surprisingly discovered that a double sheet aluminum panel consisting of two aluminum layers attached to each other by means of an adhesive layer, at least fulfils the requirements of the A2 – s1,d0 /A2 / M0 class according to European, German and French fire certifications.

In general, the adhesive layer of the present invention may be of type such as an epoxy, acrylic, phenolic, polysulfone or polyimide resin. Preferably, however, the adhesive layer may comprise a thermoplastic or most preferably a thermosetting polymer. It was found that using a thermosetting polymer adhesive provides for a strong bond, whilst the non-flammability of the inventive composite panel is maintained.

Of course, the double sheet aluminum panel according to the present invention exhibits various advantages compared with the commonly known composite panels. In particular, the inventive double sheet aluminum panel is particularly easy to produce and provides for a low-cost option for producing cladding elements. In more detail, the double sheet aluminum panel of the present invention exhibits similar mechanical properties compared to a monolithic panel. In absence of various materials combined as a core layer, the double sheet

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Claims

1. A double sheet aluminum panel ~~(1)~~ consisting of a first layer ~~(2)~~ of a first aluminum material attached to a second layer ~~(4)~~ of a second aluminum material, the first and second layers being attached to each other by means of an adhesive layer ~~(3)~~ disposed between the first and second layers ~~(2, 4)~~.

2. The double sheet aluminum panel ~~(1)~~ according to claim 1, wherein the adhesive layer ~~(3)~~ comprises polyethylen.

3. The double sheet aluminum panel ~~(1)~~ according to claim 1 or 2, wherein the adhesive layer ~~(3)~~ is composed of a first adhesive layer ~~(3a)~~ provided on an inner side of the first layer ~~(2)~~ of aluminum material facing the second layer ~~(4)~~ of aluminum material, and a second adhesive layer ~~(3b)~~ provided on an inner side of the second layer ~~(4)~~ of aluminum material facing the first layer ~~(2)~~ of aluminum material.

4. The double sheet aluminum panel ~~(1)~~ according to claim 3, wherein the first adhesive layer ~~(3a)~~ is made of an adhesive material, which is different from the adhesive material of the second adhesive layer ~~(3b)~~.

5. The double sheet aluminum panel ~~(1)~~ according to one of the claims 1 to 4, wherein the adhesive layer ~~(3)~~ has a total thickness of not more than 90 µm, preferably not more than 80 µm.

6. The double sheet aluminum panel ~~(1)~~ according to one of the claims 1 to 5, wherein the adhesive layer ~~(3)~~ consists of an adhesive material having a calorific value of less than 55 MJ/kg, preferably less than 50 MJ/kg, and more preferably less than 45 MJ/kg.

7. The double sheet aluminum panel ~~(1)~~ according to one of the claims 1 to 6, wherein the mass distribution of the adhesive material is between 0,02 g/m^2 and 0,10 g/m^2, preferably between 0,05 g/m^2 and 0,08 g/m^2, and more preferably approximately 0,07 g/m^2.

8. The double sheet aluminum panel ~~(1)~~ according to one of the claims 1 to 7, wherein a protective layer ~~(8a, b)~~ is provided on the inner side of at least one of the first and second layers ~~(2, 4)~~ of aluminum material, said protective layer preferably comprises epoxy resin.

9. The double sheet aluminum panel ~~(1)~~ according to claim 8, wherein the protective layer has a thickness, the thickness of the protective layer being adapted to the thickness of the adhesive layer ~~(3)~~.

10. The double sheet aluminum panel ~~(1)~~ according to claim 8 or 9, wherein the thickness of the protective layer and the thickness of the adhesive layer ~~(3)~~ are chosen such that the cumulated caloric value of both layers does not exceed a predetermined maximum value.

11. The double sheet aluminum panel ~~(1)~~ according to claim 10, wherein the predetermined maximum value of the cumulated caloric value is less than 6 MJ/m² and preferably 4 MJ/m².

12. The double sheet aluminum panel ~~(1)~~ according to one of the claims 8 to 11, wherein the protective layer has a thickness of between 3 µm to 10 µm, preferably of between 5 µm to 7 µm.

13. The double sheet aluminum panel ~~(1)~~ according to one of the claims 8 to 12, wherein the protective layer consists of an epoxy material having a calorific value of less than 40 MJ/kg, preferably less than 35 MJ/kg, and more preferably less than 30 MJ/kg.

14. The double sheet aluminum panel ~~(1)~~ according to one of the claims 8 to 13, wherein the mass distribution of the epoxy material is between 5 g/m^2 and 9 g/m^2 preferably between 6 g/m^2 and 8 g/m^2 and more preferably approximately 7 g/m^2.

15. The double sheet aluminum panel ~~(1)~~ according to one of the claims 8 to 14, wherein the total thickness of both, the adhesive layer ~~(3)~~ and the protective layer on at least one of the first and second layers ~~(2, 4)~~ of aluminum material does not exceed 100 µm, preferably not 80 µm and most preferably not 70 µm.

16. The double sheet aluminum panel ~~(1)~~ according to one of the claims 1 to 15, wherein an outer layer ~~(6, 7)~~ is provided on the outer side of at least one of the first and second layers ~~(2, 4)~~ of aluminum material, the outer layer ~~(6, 7)~~ being preferably a coating comprising polyester.

17. The double sheet aluminum panel ~~(1)~~ according to claim 16, wherein the outer payer ~~(6, 7)~~ has a thickness of between 20 µm to 50 µm, and preferably a thickness of approximately 30 µm to 40 µm.

18. The double sheet aluminum panel ~~(1)~~ according to claim 16 or 17, wherein the outer layer ~~(6, 7)~~ consists of a polyester material having a calorific value of less than 18 MJ/kg, preferably less than 16 MJ/kg, and more preferably less than 14 MJ/kg.

19. The double sheet aluminum panel ~~(1)~~ according to one of the claims 16 to 18, wherein the mass distribution of the polyester material is between 35 g/m^2 and 75 g/m^2, preferably between 45 g/m^2 and 65 g/m^2, and more preferably approximately 55 g/m^2.

20. The double sheet aluminum panel ~~(1)~~ according to one of the claims 1 to 19, wherein the first aluminum material is substantially the same as the second aluminum material.

21. The double sheet aluminum panel ~~(1)~~ according to one of the claims 1 to 19, wherein the first aluminum material is different from the second aluminum material.

22. The double sheet aluminum panel ~~(1)~~ according to claim 20 or 21, wherein the first aluminum material of the first layer ~~(2)~~ is a 3000 or 5000 series aluminum alloy.

23. The double sheet aluminum panel ~~(1)~~ according to one of the claims 20 to 22, wherein the second aluminum material of the second layer ~~(4)~~ is a 3000 or 5000 series aluminum alloy.

24. The double sheet aluminum panel ~~(1)~~ according to one of the claims 1 to 23, wherein the first and second layers ~~(2, 4)~~ comprise substantially the same thickness.

25. The double sheet aluminum panel ~~(1)~~ according to one of the claims 1 to 24, wherein the first and second layers ~~(2, 4)~~ comprise a different thickness.

26. The double sheet aluminum panel ~~(1)~~ according to one of the claims 1 to 25, wherein the first and/or second layer ~~(2, 4)~~ of aluminum material has a thickness of between 0,8 mm and 2,5 mm, preferably between 1,0 mm and 2,0 mm, and more preferably of approximately 1,5 mm.

27. The double sheet aluminum panel ~~(1)~~ according to one of the claims 1 to 26, wherein the double sheet aluminum panel ~~(1)~~ has a thickness of between 1 mm and 10 mm, preferably between 2 mm and 7 mm, and more preferably between 2,5 mm and 5 mm.

28. The double sheet aluminum panel ~~(1)~~ according to one of the claims 1 to 27, wherein the double sheet aluminum panel ~~(1)~~ comprises at least one opening penetrating at least the first and second layers ~~(2, 4)~~ of aluminum material.

29. The double sheet aluminum panel ~~(1)~~ according to one of the claims 1 to 28, wherein the double sheet aluminum panel ~~(1)~~ is perforated.

30. A method for manufacturing a double sheet aluminum panel according to one of the claims 1 to 29, the method comprising the following steps:

- providing a first sheet of a first aluminum material;
- providing a second sheet of a second aluminum material;
- applying an adhesive to inner surfaces of the first and/or second layers;
- roll bonding the first and second sheets together along their inner surfaces to form a laminate aluminum sheet consisting of two layers of aluminum material attached to each other by means of the adhesive;
- cutting the laminate aluminum sheet into double sheet aluminum panels.

31. The method according to claim 30,
wherein the adhesive is heated before roll bonding is performed.

32. The method according to claim 30 or 31,
wherein at least the inner surfaces of the first and second layers are smoothened by means of abrasion before the adhesive is applied.

33. The method according to one of the claims 30 to 32,
wherein at least the inner surfaces of the first and second layers are treated with conversion coating before the adhesive is applied.

34. The method according to one of the claims 30 to 33,
wherein at least the outer surfaces of the first and second layers are treated with paint before the adhesive is applied.

35. The method according to one of the claims 30 to 34,
wherein rolling is performed by means of pressure rollers in such a way that a double sheet aluminum panel having a thickness of 1 to 10 mm is produced.