Claims

1. An ionizing radiation shielding panel comprising:

a core layer comprising a radiation attenuating material,

a first layer on a first side of the core layer, comprising a permeable reinforcement structure,

a second layer on a second side of the core layer, opposite to the first side, comprising a permeable reinforcement structure;

wherein the first layer, second layer and core layer are permeated with a binder.

2. The~~An~~ ionizing radiation shielding panel according to claim 1 wherein the permeable reinforcement structure of the first or second layers is a fabric and comprises glass fibre, or metal filaments, or carbon fibre, or poly-paraphenylene terephthalamide.

3. The ~~An~~ ionizing radiation shielding panel ~~article~~ according to claim 1~~ or 2~~ wherein the permeable reinforcement structure of the first layer or second layer, or both the first layer and the second layer comprises a woven fibre cloth, randomly orientated chopped fibre strands, or continuous filaments arranged in a mat, or an array of filaments.

4. The~~An~~ ionizing radiation shielding panel according to ~~claims~~ claim 1~~, 2 or 3~~ wherein the first layer or second layer, or both the first layer and the second layer, comprises two or more sheets of the permeable reinforcement structure.

5. The~~An~~ ionizing radiation shielding panel according to ~~any one of the preceding claims~~ claim 1 wherein the first layer or the second layer, or both the first layer and the second layer, comprises a binder spreader layer.

6. TheAn ionizing radiation shielding panel according to claim 5 wherein the binder spreader layer is positioned between the permeable reinforcement structure and the core layer, and wherein the first layer or the second layer, or both the first layer and the second layer, further comprises a second permeable reinforcement structure positioned between the binder spreader layer and the core layer.

7. TheAn ionizing radiation shielding panel according to any one of the preceding claims claim 1 wherein the radiation attenuating material comprises greater than 65 % of the binder permeated core layer by volume.

8. TheAn ionizing radiation shielding panel according to any one of the preceding claims claim 1 wherein the radiation attenuating material comprises an element having an atomic mass greater than 47 unified atomic mass units.

9. TheAn ionizing radiation shielding panel according to any one of the preceding claims claim 1 wherein the radiation attenuating material is barite.

10. TheAn ionizing radiation shielding panel according to any one of the preceding claimsclaim 1, wherein the radiation attenuating material is a particulate, and a the diameter of a the largest particle of the radiation attenuating material is not more than 10% of the thickness of core layer.

11. TheAn ionizing radiation shielding panel according to any preceding claim 1 further comprising a mechanical load distribution structure.

12. TheAn ionizing radiation shielding panel according to claim 11, wherein the mechanical load distribution structure layer comprises a metal sheet.

13. TheAn ionizing radiation shielding panel according to claim 11 or 12, wherein the mechanical load distribution structurelayer is embedded in the binder.

14. TheAn ionizing radiation shielding panel according to claim 11 or 12, wherein the mechanical load distribution structurelayer forms an external layer of the ionizing radiation shielding panel and is adhered to the binder.

15. An enclosure comprising a plurality of ionizing radiation shielding panels according to any one of claims 1 to 14claim 1.

16. TheAn enclosure according to claim 15, wherein the plurality of ionizing radiation shielding panels comprise one or more features that allow a labyrinth to be formed at a junction of at least two of the plurality of ionizing radiation shielding panels.

17. A method for producing an ionizing radiation shielding panel, comprising:

placing a first layer comprising a permeable reinforcement structure into a mould;

depositing particulate radiation attenuating material into the mould on top of the first layer;

placing a second layer comprising a permeable reinforcement structure into the mould;

closing the mould;

injecting binder into the mould from at least one binder port;

establishing a pressure difference across the mould between at least one binder port and at least one outlet port, such that when the binder is injected into the mould the binder is drawn from the at least one binder port to the at least one outlet port and permeates the first layer, the radiation attenuating material and the second layer in the mould; and

~~hardening the binder.~~

~~18. A method for producing an ionizing radiation shielding panel according to claim 17 wherein the at least one binder port is on an opposite side of the mould to the at least one outlet port.~~

~~19. A method for producing an ionizing radiation shielding panel according to claim 17 or 18, further comprising the step of compressing the radiation attenuating material, prior to the step of injecting the binder.~~

~~20. A method for producing an ionizing radiation shielding panel according to any one of claims 17 to 19 wherein the step of establishing a pressure difference comprises applying a pressure between 50000 Pa and 100000 Pa below atmospheric pressure.~~

~~21. A method for producing an ionizing radiation shielding panel according to any one of claims 17 to 20 wherein the step of establishing a pressure difference across the mould comprises injecting the binder from the at least one binder port at a pressure above atmospheric pressure.~~

~~22. A method for producing an ionizing radiation shielding panel according to any one of claims 17 to 21 wherein the binder from the at least one binder port is injected at a pressure of between 50000 Pa and 400000 Pa above atmospheric pressure.~~

~~23. A method for producing an ionizing radiation shielding panel according to any one of claims 17 to 22, wherein a portion of the mould comprises a flexible sheet.~~

24. A method for producing an ionizing radiation shielding panel according to any one of claims 17 to 23, wherein a portion of the mould adheres to the binder and forms a part of the ionizing radiation shielding panel.

25. An x-ray inspection apparatus comprising:

a housing,

an x-ray source,

an x-ray detector, and

a support for objects to be imaged, the support being positioned between the x-ray source and the x-ray detector;

wherein the housing comprises one or more walls, wherein at least a portion of the one or more walls comprises:

a core layer comprising a radiation attenuating material,

a first layer comprising a permeable reinforcement structure, on a first side of the core layer,

a second layer comprising a permeable reinforcement structure, on a second side of the core layer, opposite to the first side;

wherein the first layer, second layer and core layer are permeated with a binder.

26. An x-ray inspection apparatus according to claim 25, wherein each of the walls comprises:

a core layer comprising a radiation attenuating material,

a first layer comprising a permeable reinforcement structure, on a first side of the core layer,

a second layer comprising a permeable reinforcement structure, on a second side of the core layer, opposite to the first side;

~~wherein the first layer, second layer and core layer are permeated with a binder.~~

17. The ionizing radiation shielding panel according to claim 1, wherein at least one of the first layer and the second layer comprises a binder spreader layer, wherein the binder spreader layer is positioned between the permeable reinforcement structure of the first layer and the core layer and the permeable reinforcement structure of the second layer is positioned between the binder spreader layer and the core layer, and wherein the binder comprises a resin and permeates the binder spreader layer.

18. The ionizing radiation shielding panel according to claim 1, wherein at least one of the first layer and the second layer comprise a binder spreader layer positioned between a first mat of fibre strand and a second mat of fibre strand and the binder spreader layer comprises a resin that permeates the binder spreader layer.

19. An ionizing radiation shielding panel comprising:

a core layer comprising a radiation attenuating material,

a first layer on a first side of the core layer, comprising a permeable reinforcement structure; and

a second layer on a second side of the core layer, opposite to the first side, comprising a permeable reinforcement structure,

wherein the first layer, second layer and core layer are permeated with a binder,

wherein at least one of the first layer and the second layer comprises a binder spreader layer and a second permeable reinforcement structure,

wherein the binder spreader layer is positioned between the permeable reinforcement structure of the first layer and the core layer and the permeable reinforcement structure of the second layer is positioned between the binder spreader layer and the core layer, and

wherein the binder comprises a resin and permeates the binder spreader layer.

20. The ionizing radiation shielding panel according to claim 19 wherein the permeable reinforcement structure of the first or second layers is a fabric and comprises glass fibre, or metal filaments, or carbon fibre, or poly-paraphenylene terephthalamide.

21. The ionizing radiation shielding panel according to claim 19 wherein the permeable reinforcement structure of the first layer or second layer, or both the first layer and the second layer comprises a woven fibre cloth, randomly orientated chopped fibre strands, or continuous filaments arranged in a mat, or an array of filaments.

22. The ionizing radiation shielding panel according to claim 19 wherein the first layer or second layer, or both the first layer and the second layer, comprises two or more sheets of the permeable reinforcement structure.

23. The ionizing radiation shielding panel according to claim 19 wherein the first layer or the second layer, or both the first layer and the second layer, comprises a binder spreader layer.

24. The ionizing radiation shielding panel according to claim 23 wherein the binder spreader layer is positioned between the permeable reinforcement structure and the core layer, and wherein the first layer or the second layer, or both the first layer and the second layer, further comprises a second permeable reinforcement structure positioned between the binder spreader layer and the core layer.

25. An ionizing radiation shielding panel comprising:

a core layer comprising a radiation attenuating material,

a first layer on a first side of the core layer, comprising a permeable reinforcement structure; and

a second layer on a second side of the core layer, opposite to the first side, comprising a permeable reinforcement structure,

wherein the first layer, second layer and core layer are permeated with a binder, and

wherein at least one of the first layer and the second layer comprise a binder spreader layer positioned between a first mat of fibre strand and a second mat of fibre

strand and the binder spreader layer comprises a resin that permeates the binder spreader layer.

26. The ionizing radiation shielding panel according to claim 25 wherein the permeable reinforcement structure of the first or second layers is a fabric and comprises glass fibre, or metal filaments, or carbon fibre, or poly-paraphenylene terephthalamide.

27. The ionizing radiation shielding panel according to claim 25 wherein the permeable reinforcement structure of the first layer or second layer, or both the first layer and the second layer comprises a woven fibre cloth, randomly orientated chopped fibre strands, or continuous filaments arranged in a mat, or an array of filaments.

28. The ionizing radiation shielding panel according to claim 25 wherein the first layer or second layer, or both the first layer and the second layer, comprises two or more sheets of the permeable reinforcement structure.

29. The ionizing radiation shielding panel according to claim 25 wherein the first layer or the second layer, or both the first layer and the second layer, comprises a binder spreader layer.

30. The ionizing radiation shielding panel according to claim 29 wherein the binder spreader layer is positioned between the permeable reinforcement structure and the core layer, and wherein the first layer or the second layer, or both the first layer and the second layer, further comprises a second permeable reinforcement structure positioned between the binder spreader layer and the core layer.