A gas burner membrane is provided. The membrane comprises a textile woven, braided or knitted fabric. This membrane further comprises different combustion zones on its burner surface. A method to provide such gas burner membrane is described.
GAS BURNER MEMBRANE

FIELD OF THE INVENTION

[0001] The present invention relates to a gas burner membrane and a method to provide such.

BACKGROUND OF THE INVENTION

[0002] Gas burner membranes out of sintered metal fiber mats and comprising different combustion zones is known from U.S. Pat. No. 5,439,372.

[0003] WO9704152 describes a method to provide a gas burner membrane out of metal fibers.

[0004] It is generally known that sintered metal fiber mats are stiff and therefore difficult to bend or shape into a burner surface, other than flat. Moreover, during combustion, the sintered mats expand and tend to lift up when they are fixed to the burner housing.

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide an alternative gas burner membrane comprising different combustion zones. Also a method to provide such a gas burner membrane is explained.

[0006] To provide a gas burner membrane as subject of the invention, textile fabrics comprising metal fibers are provided. Within the context of the present invention, a textile fabric refers to a flexible fabric, comprising fibers and being a woven, braided, knitted or nonwoven structure. It does not refer to sintered metal fiber surfaces, which are not flexible. Over its surface, the textile fabric has at least two zones, which have a different air permeability.

[0007] When this textile fabric is used as gas burner membrane, the different zones of the textile fabric provide different combustion zones to the gas burner membrane.

[0008] A gas burner membrane as subject of the invention comprises at least a basic textile fabric layer. Different zones of the textile fabric with different air permeability may be provided to this basic textile fabric layer according to the present invention, in several different ways.

[0009] A first gas burner membrane as subject of the invention may be provided by adding one or more additional layers of textile fabric on the basic textile fabric layer at certain zones. The various layers of textile fabric are fixed one to another, preferably by spot welding.

[0010] An alternative gas burner membrane as subject of the invention is provided using different textile structures to provide the different zones of the textile fabric, with different air permeability.

[0011] In case the textile fabric is a woven textile fabric, different textile structures may e.g. be obtained by:

[0012] Using locally different warp and/or weft yarns, e.g. using locally finer or coarser yarns, having a different metric number (hereafter referred to as Nm, being length of one gram of yarn);

[0013] Using locally a different weaving density, e.g. by increasing or decreasing the number of warp and/or weft yarns per length units of the woven textile fabric;

[0014] Using locally a different weaving pattern, e.g. using locally a satin weaving pattern, a rib weaving pattern, a plain weaving pattern, or any other weaving pattern.

[0015] All this resulting in zones in the textile fabric, having different air permeability, providing different combustion zones to the gas burner membrane.

[0016] When a knitted textile fabric is provided, the number of yarns, the yarn thickness or the knitting structure may be different in specific zones of the fabric. Also, larger or smaller stiches may be provided locally. All this resulting in zones in the textile fabric having a different air permeability.

[0017] Another alternative gas burner membrane as subject of the invention is provided by using different yarns to provide the textile fabric, said yarns comprising a different quantity of polymer or natural fibers, next to metal fibers. These yarns may be used to provide a fabric as subject of the invention, e.g. by weaving, braiding or knitting. When Polymer fibers are removed, e.g. by burning them out of the textile fabric, a fabric consisting of metal fibers is left, which comprises various zones. Each zone has different air permeability, dependent on the quantity of metal fibers left in this zone. Yarns having a core consisting of metal fibers, and comprising polymer fibers which cover partially of fully this core may be used.

[0018] Alternatively, yarns comprising metal fiber may also comprise ceramic fibers or ceramic fiber yarns. It was found that gas burner membranes, comprising metal fibers and ceramic fibers on its burner surface are more resistant to higher temperatures as compared to 100% metal fiber gas burner membranes. “Burner surface” is to be understood as the surface of the gas burner membrane, at which side the combustion takes place. At the same time, they are more resistant to mechanical damage as compared to 100% ceramic fiber gas burner membranes. Preferably, a metal fiber yarn is first covered partially or fully with ceramic fibers, e.g. by wrap spinning of ceramic fiber yarns around the metal fiber. Polymer or natural fibers may then be added to this combination e.g. by wrap spinning or core spinning techniques.

[0019] Different types of ceramic fibers may be used to provide the yarns present in the textile fabric for a gas burner membrane as subject of the invention. Ceramic fibers may e.g. be Al₂O₃—based fibers, further comprising SiO₂. NEXTEL®-fibers are such fibers which may be used. Ceramic fibers based on Al₂O₃ may be used, e.g. fibers comprising 62% by weight Al₂O₃, 24% by weight SiO₂ and 14% by weight B₂O₃. Preferably however, SiO₂-based fibers are used, such as QUARTZEL® fibers from Quartz & Silice, which comprises more than 99.99% SiO₂.

[0020] When ceramic fibers are used, next to metal fibers to provide the textile fabric of the gas burner membrane, preferably more ceramic fibers are used to provide the combustion zones with the lowest air permeability.

[0021] When a textile fabric, comprising such zones with different air permeability is used as a gas burner membrane, each zone will provide a specific combustion zone to the gas burner membrane. As a consequence, due to the different air permeability, different amounts of gas flowing through these zones cause different firings rates and provide different combustion zones to the gas burner membrane, and this at a
firing load, which is equal for the whole gas burner membrane. “firing load” is to be understood as the volume of combustible gas which is provided to a gas burner membrane surface per time unit. So to say, during combustion, the combustion zones having highest air permeability will preferably provide non-radiant combustion, whereas the zones with lower air permeability preferably provide a radiant combustion. According to the invention, the zones, which are closest to the frame in which the gas burner membrane is mounted, have low air permeability so providing preferably radiant combustion to improve the combustion stability.

[0022] A gas burner membrane as subject of the invention thus may comprise various combustion zones, wherein the zones differ in air permeability due to a number of layers of textile, one on top of the other, or to varying textile structure in the textile fabric.

[0023] Such a gas burner membrane provides the same benefits as a gas burner membrane as described in U.S. Pat. No. 5,439,372, but does not have the disadvantages of the sintered metal fiber surfaces and includes the advantage of having a very flexible and drapable gas burner membrane.

[0024] In case various layers of textile fabric are used to provide a gas burner membrane as subject of the invention, possibly but not necessarily, the various layers of textile fabric may be provided out of the same textile fabric. So only one textile fabric, with its specific structure is to be manufactured. Various zones, each with its specific shape or design can be provided just by cutting the surfaces to the various zones out of this fabric and adding them one on top of the other. This provides a very flexible method for designing different gas burner membranes with different zones (as to say custom or tailor made).

[0025] It is clear that different textile fabrics, having a different structure may also provide the various layers. The fact that only one or a small number of different textile structures is to be made in order to be able to manufacture a large type of different combustion zones clearly provides economical advantages.

[0026] Also in case different textile structures are used locally to provide a textile fabric, a large amount of possibilities are met to design a gas burner membrane with different combustion zones. Designing the textile fabric can be done in such a way that no material is to be cut away before the textile fabric can be used as a gas burner membrane.

[0027] All type of metal fibers may be used. Fibers obtained by bundle drawing, shaving or cutting action may be used. The equivalent diameter of the metal fibers are usually between 10 and 150 μm, but preferably between 25 and 50 μm, e.g. 25 μm, 30 μm or 35 μm. The metal fibers can be different types of stainless steel, nickel alloys and other specific types of steel containing, for example, chromium, aluminum and/or nickel and 0.05 to 0.3% by weight of yttrium, cerium, lanthanum, hafnium or titanium.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The invention will now be described into more detail with reference to the accompanying drawings wherein

[0029] FIG. 1 shows a knitting structure, which provides a textile fabric to be used as a textile layer.

[0030] FIG. 2 shows a gas burner membrane as subject of the invention comprising various textile layers over its surface.

[0031] FIG. 3 shows another gas burner membrane as subject of the invention comprising different textile structures over its knitted surface.

[0032] FIG. 4 shows a gas burner comprising a gas burner membrane as subject of the invention.

[0033] FIG. 5 shows another gas burner membrane as subject of the invention comprising different textile structures over its woven surface.

DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

[0034] A knitted textile fabric, to be used as a basic textile fabric layer to provide a gas burner membrane as subject of the invention may be provided by knitting sets of yarns 11, 12 and 13 according to the knitting structure as shown in FIG. 1. The fabrics are provided by knitting on a double bed knitting machine, gauge 5 from H. STOLL GmbH & Co.—Reutlingen (D), knitted on all needles 14. Three sets of yarn (11, 12 and 13) are knitted consecutive on the front (F) and rear (R) needle bed following the knitting steps I to IV as shown in FIG. 1. For each yarn group 11, 12 or 13, two yarns of metal fibers are used simultaneously. Each yarn having a titer of 334 tex, comprise metal fibers of alloy type FERCRALLOY®, having a diameter of approximately 25 μm. A knitted fabric with thickness of 1.7 mm and weight of 1.3 kg/m² is provided, having an air permeability of 2100 to 2300 l/dm² min. This air permeability, like all air permeabilities mentioned in this document, was measured using a pressure gradient of 200 Pa.

[0035] Alternatively, a yarn comprising metal and ceramic fibers is used to provide a basic textile fabric layer. As an example, a yarn is obtained using a bundle of metal fibers, having a titer of 333 tex (333 gram per kilometer yarn), and being wrapped with a fine PA yarn with titer 156 dtex. This consolidated metal fiber bundle is then wrapped with a ceramic fiber yarn, preferably a ceramic yarn being a ply of two Quartz®-yarns, each Quartz® yarn being a plied yarn of two times 120 filaments of 9 μm diameter each. The ceramic yarn thus comprises approximately 480 filaments, providing a ceramic yarn of 66 Tex. This ceramic fiber wrapped consolidated metal fiber bundle is then wrapped with polyamid fibers, to provide a yarn which has an outer layer, being substantially provided by this polyamid fibers. The content of such yarn is approximately 63% by weight of metal fiber, 29% by weight of ceramic (Quartz®-) fiber and 8% by weight of polyamid fiber.

[0036] As shown in FIG. 2, a basic textile fabric layer 21 is used, layer 21 being a knitted fabric as provided by the structure of FIG. 1. Several strips 22 are cut out of an identical knitted fabric, and spot welded to the basic fabric layer. If required, more than one strip may be added on top of the other. When this textile fabric with its different zones 23, 24 and 25 is used as a gas burner membrane, each of the zones will have its own firing rate. This since the air permeability in zone 23 is different of the air permeability in zone 24 and 25.

[0037] Air permeability of 2100 to 2300 l/dm² min is measured at zone 24, comprising only one layer of the
knitted fabric, where an air permeability of 1500 l/\text{dm}^2 \text{min} is measured at zones 23, having two layers of textile fabric an air permeability of 1200 l/\text{dm}^2 \text{min} is obtained in zones 25 having three layers of textile fabric.

[0038] An alternative is shown in FIG. 3, where a knitted textile fabric is provided, having different knitting structures over its surface. During the knitting process, a fabric is provided over its surface. The woven basic textile fabric layer is shown in FIG. 1. During this knitting action, zones 31 are knitted using two yarns of a titer of 334 tex, comprise metal fibers of alloy type FERCALLOY\textsuperscript{®}, having a diameter of approximately 25 μm. Zone 32 is provided using only one of such yarn, whereas zone 33 is provided using three of these yarns. Zones 31 are then obtained having an air permeability of 2100 to 2300 l/\text{dm}^2 \text{min}, whereas zone 32 has an air permeability of 3000 to 3200 l/\text{dm}^2 \text{min} and zone 33 has an air permeability of 1350 to 1500 l/\text{dm}^2 \text{min}.

[0039] As shown in FIG. 4, zones 41 of a gas burner membrane 42 being located closest to the frame 43 in which the gas burner membrane is mounted, provide radiant combustion. Over the surface of the gas burner membrane, different zones 44 and 45 may be located, each characterized by their specific air permeability and so providing preferably non-radiant or radiant combustion.

[0040] Another alternative gas burner membrane is shown in FIG. 5, which comprises a woven basic textile fabric layer 50, having different zones with a different air permeability over its surface. The woven basic textile fabric layer is provided using a plain weaving structure. In weft direction 51, a warp density of seventy-two yarns per 10 cm of textile fabric is used in the zones 52. A warp density of fifty yarns per 10 cm is used to provide zones 53. In weft direction 54, a weft density of twenty-two yarns per 10 cm of textile fabric is used in the zones 55. A weft density of thirty-two yarns per 10 cm is used to provide zones 56. Four different zones 57, 58, 59 and 60 are obtained, each zone having an air permeability depending from the warp and weft density in that zone. When this woven basic textile fabric layer is used to provide a gas burner membrane, 4 different combustion zones, each zone related to a zone 57, 58, 59 or 60 of the textile fabric, may be obtained.

[0041] Preferably, but not necessarily, a yarn comprising metal and ceramic fibers is used to provide the woven basic textile fabric layer. Preferably, the yarn, comprises a bundle of metal fibers, having a titer of 333 tex (333 gram per kilometer yarn), and being wrapped with a fine PA yarn with titer 156 dtex. This consolidated metal fiber bundle is then wrapped with a ceramic fiber yarn, preferably a ceramic yarn being a ply of two Quartzgel®-yarns, each Quartzgel®-yarn being a plicated yarn of two times 120 filaments of 9 μm diameter each. The ceramic yarn thus comprises approximately 480 filaments, providing a ceramic yarn of 66 Tex. This ceramic fiber wrapped consolidated metal fiber bundle is then wrapped with polyamide fibers, to provide a yarn which has an outer layer, being substantially provided by this polyamide fibers. The content of such yarn is approximately 63% by weight of metal fiber, 29% by weight of ceramic (Quartzgel®-) fiber and 8% by weight of polyamide fiber.

1 A gas burner membrane comprising a textile fabric, said textile fabric comprising metal fibers, characterized in that said textile fabric comprising more than one zone, at least one of said zones having a different air permeability compared to the other said zones, said zones of said textile fabric providing at least two different combustion zones to said gas burner membrane.

2 A gas burner membrane as in claim 1, wherein said textile fabric consists of metal fibers.

3 A gas burner membrane as in claim 1, wherein said textile fabric comprises ceramic fibers.

4 A gas burner membrane as in claim 1 or 3, wherein at least one of said combustion zones comprise more than one layer of said textile fabric to provide said different air permeability.

5 A gas burner membrane as in claim 4, wherein said layers of textile fabric are fixed to each other by spot welding.

6 A gas burner membrane as in claim 4 to 5, wherein said layers are of an identical textile structure.

7 A gas burner membrane as in claim 4 to 5, wherein said layers are of a different textile structure.

8 A gas burner membrane as in claim 1 to 3, wherein said zones of said textile fabric are provided by a different textile structure.

9 A gas burner membrane as in claim 1 to 8, wherein at least one textile fabric is a knitted fabric.

10 A gas burner membrane as in claim 1 to 9, wherein all textiles are knitted fabrics.

11 A gas burner membrane as in claims 1 to 10, said gas burner membrane being fixed in a frame, wherein said zones located closest to said frame, having the lowest air permeability compared to the other of said zones.

12 A method of manufacturing a gas burner membrane, said method comprising the steps of providing a textile fabric comprising different zones, said zones being provided by different textile structures.

13 A method to provide a gas burner membrane, comprising the steps of providing textile fabric, said fabric comprising metal fibers, using said textile fabric as a basic textile fabric layer; adding more than one layer of textile fabrics at one or more zones of said basic textile fabric layer; fixing layers of textile fabric to another;

14 A method according to claim 12, said method further comprising the step of fixing of said textile fabric layers is done by spot welding.

15 Use of a gas burner membrane as in claim 1 to 10 for gas combustion, applying at least two different firing rates simultaneously on said gas burner membrane.

16 Use of a gas burner membrane obtainable by a method as in claim 11 to 13 for gas combustion, applying at least two different firing rates simultaneously on said gas burner membrane.

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