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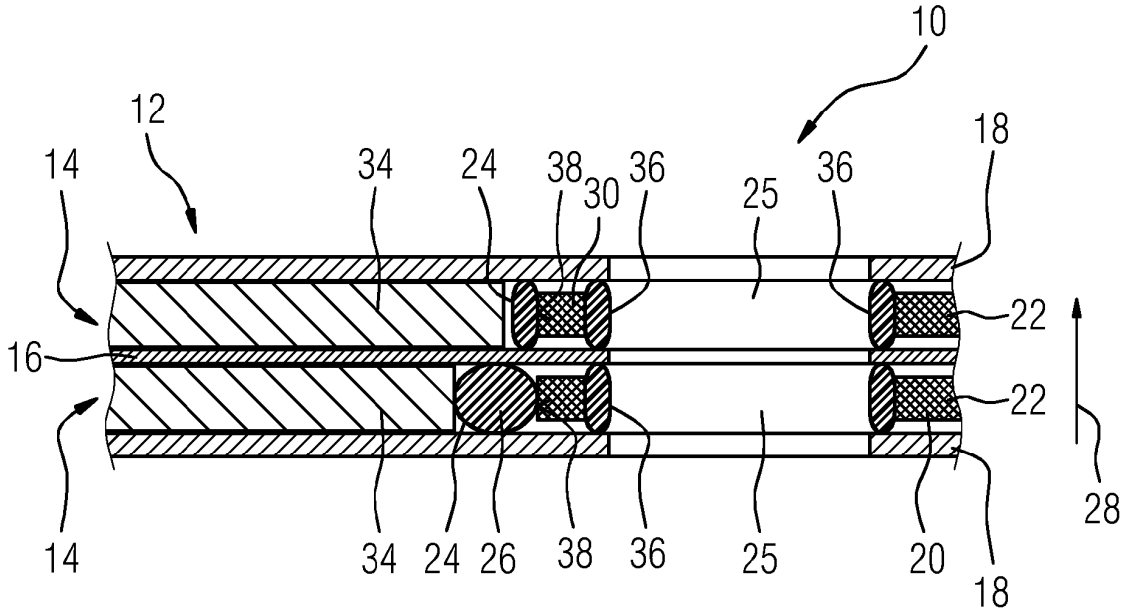
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(54) **DESIGN OF A SEALING FOR AN ELECTROLYZER**

(57) The invention concerns an electrolyzer (10) comprising several layers (14, 16, 18) arranged as a stack (12), a first gasket (20) being part of one of the several layers (14, 16, 18), having a base plate (22) with a recess (24), a first elastomer sealing (26) connected to the base plate (22) of the first gasket (20) in such that it frames the recess (24) of said base plate (22), a second gasket (30) being part of a further of the several layers (14, 16, 18) and having a base plate (22) with a recess (24) and a second elastomer sealing (36) connected to the base plate (22) of the second gasket (30) in such that it frames the recess (24) of said base plate (22), wherein said first elastomer sealing (26) has a larger thickness than said second elastomer sealing (36).

FIG 2



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Description

[0001] The invention concerns an electrolyzer and a method for operating an electrolyzer.

[0002] An electrolyzer usually consists of a stack with several layers arranged on top of each other. In this way, an anode and a cathode are, for example, separated by a membrane and/or a gas diffusion layer or a porous transport layer to provide selective ion conductivity. Further, such an electrolysis cell stack can be physically supported on each side by conductive polar plates. Polar plates are configured to apply electric potential between the cathode and the anode to drive oxidation and reduction reactions of reactant fluids. Such reactant fluids are transported towards the anode and cathode through flow fields often supported by the polar plates.

[0003] In an assembled state of the electrolysis cell stack, the adjacent layers of the stack are brought in contact with each other. This is mainly realized by compressing the stack in a final assembling step. However, the effort for a precise manufacturing of all of the different layers having different physical properties, and in addition for precisely arranging said fundamental different layers to said stack, is quite high. Therefore, positional and geometrical tolerances have to be accepted in a predetermined manner. However, due to said tolerances, it becomes possible that certain layers can move within the stack. This, again, results in gaps between interlayer components, as for example, a sealing and a gas diffusion layer or a porous transport layer. Due to such gaps, adjacent layers can be unsupported. As a result, sensible layers can be impaired or damaged. Further, said movement can lead to the problem, that an operation state of the electrolyzer is impaired, as certain layers do not fulfil its function. In particular, impairing or damaging a layer designed as a membrane can lead to a significantly reduced efficiency and/or lifetime span of the electrolyzer.

[0004] The object underlying the present invention is to avoid movement of separate layers in a stack of an electrolyzer.

[0005] This object is achieved by an electrolyzer according to the features of claim 1.

[0006] Furthermore, an object underlying the present invention is to provide a method to operate an electrolyzer.

[0007] This object is achieved by a method according to the features of claim 14.

[0008] Preferred embodiments of the invention are subject of the dependent claims and the following description.

[0009] The electrolyzer according to the invention comprises several layers arranged as a stack. Preferably, the several layers are arranged in a stacking direction as said stack. Further, the electrolyzer according to the invention comprises a first gasket being part of one of the several layers of said stack. Moreover, the first gasket of the electrolyzer has a base plate with a recess. In particular, said base plate is a metal base plate. The base plate can have several recesses. Each of these several recesses can be framed by one of several elastomer sealings. In a preferred manner, each of these several elastomer sealings frames a complete circumference of a corresponding recess of the several recesses of the base plate. Additionally, the electrolyzer comprises a first elastomer sealing connected to the base plate in such that it frames the recess of said base plate. The framed recess is in particular provided for accommodating a gas diffusion layer or a porous gas transport layer. Advantageously, the first elastomer sealing connected to the first gasket frames a complete circumference of a corresponding recess. Preferably, said recess is arranged in the center of the base plate. Additionally, the electrolyzer comprises a second gasket being part of a further of the several layers and having a base plate with a recess. In particular, the base plate and the recess are of the same kind as described before. Further, a second elastomer sealing is provided, connected to the base plate of the second gasket in such that it frames the recess of said base plate. A thickness of the first elastomer sealing is larger than a thickness of said second elastomer sealing.

[0010] In the context of the present invention, and if not otherwise described, the thickness of the sealing represents a size of the sealing, measured in radial direction of the sealing. The radial direction is measured substantially perpendicular to a longitudinal direction of the sealing. Preferably, the thickness of the sealing is measured along a non-curved section of said longitudinal direction. Moreover, in the present context, deformations of the sealing, in particular a compression, for example, due to a curvature in edges of the recess, shall not be regarded as an enlarged thickness of the sealing. For the sake of a better readability, the "elastomer sealing" is in parts of the present description solely denoted by "sealing", which, however, denotes consistently the same as "elastomer sealing".

[0011] A partly expanded elastomer sealing profile of the first sealing allows to tolerate small gaps between different components of a layer. Further, by means of the enlarged elastomer sealing it can be avoided that an adjacent layer becomes unsupported and consequently could fail. Tolerance deviations relative to an opposing layer can thus be easily compensated. Preferably, by means of the enlarged thickness of at least a section of the sealing, an interference fit can be realized. In this way, the layers of the stack can be carefully tensed up. Additionally, the displacement of separate layers relative to other layers can be tolerated. Hence, a reliable and safe operation of an electrolyzer can be provided.

[0012] In a preferred embodiment of the electrolyzer, said first sealing has a thickness that is at least 1.5-times, preferably 2-times and in particular 2.5-times, larger than said second sealing. An enlarged profile of the first sealing can be sized in accordance with expected positional tolerances deviations. Thus, a reliable and safe operation of the electrolyzer can be realized with less effort.

[0013] Further, in a preferred embodiment of the electrolyzer a maximal thickness of the first sealing, measured in a direction transverse to a stacking direction of said stack is larger than a maximal thickness of said second sealing, measured in the same direction. Preferably, the maximal thickness is measured in a direction substantially perpendicular to said stacking direction. In this way, the first sealing can be provided with an enlarged supporting surface. By this means, forces can be charged to adjacent layers of the stack in a conservative manner. Impairing or damaging adjacent layers caused by a pressure provided by the large thickness of the sealing can be counteracted. In this way, a reliable operation can be enabled.

[0014] Advantageously, in a compressed state of the stack said first sealing has a larger thickness in a direction substantially perpendicular to a stacking direction than said second sealing. In the compressed state of the electrolyzer, at least a part of each of the layers is in contact with a part of a directly adjacent layer. Nevertheless, a play between certain parts of adjacent layers of the stack can occur. A lateral expansion of the sealing profile enables the avoidance of gaps. This allows to circumvent unsupported parts of layers of the stack. Moreover, by means of the lateral expansion of the thickness of at least a section of the sealing, compensation of geometrical or positional tolerances of layers arranged in the stack or different components arranged in one layer can be realized.

[0015] Preferably, in case of the compressed state of the stack said first sealing has the same thickness as said second sealing, measured in stacking direction. In this way, a substantially planar extend of layers of the stack can be provided. Thus, it can be avoided that certain layers are waved or bent. Accordingly, local pressures or stresses can be kept low or even avoided.

[0016] In another preferred embodiment, said first sealing frames a central recess of the base plate of the first gasket and said second sealing frames a central recess of the base plate of the second gasket. This allows to realize an electrolysis cell design for providing a safe, efficient and reliable operation. Accordingly, the second gasket can have several recesses. Each of these recesses can be framed by a separate elastomer sealing. In particular, the second sealing framing a central recess of the several recesses of the base plate of the second gasket has a smaller thickness than the first sealing of the first gasket, which frames a central recess of the first gasket. Furthermore, said second sealing framing the central recess of the base plate of the second gasket can have the same thickness as a further sealing of the first gasket framing one of the corresponding recesses. Moreover, all sealings framing a recess of the several recesses of the base plate of the second gasket can have substantially the same thickness. In case that several further gaskets are provided, advantageously all sealings framing a recess, preferably a central recess, of a base plate of one of the several further gaskets have substantially the same thickness as the second sealing of the second gasket. This makes it possible to provide uniform sealings. The number of different components needed for assembling the stack can therefore be kept low. Further, standard components can be used for the construction of the electrolyzer.

[0017] Said sealing of the second gasket has a smaller thickness than said first sealing of the first gasket. Preferably, further sealings of the first gasket and/or further sealings of the second gasket, each framing a corresponding recess, have a smaller thickness than said first sealing of the first gasket. This allows to provide a fixation for all layers of the stack. Further, in this way, an easy-to-assemble stack can be provided. An effort for keeping geometrical and/or positional tolerances small can be minimized. In addition, a construction and manufacturing process as well as an assembling process can be simplified and accelerated with little effort.

[0018] In an advantageous embodiment, the second sealing of the second gasket has along its entire longitudinal direction a smaller thickness than said first sealing of the first gasket. In particular, the second sealing framing the recess of the base plate of the second gasket has along a complete circumference of the corresponding recess a smaller thickness than said first sealing of the first gasket. In certain cases, the second sealing of the second gasket can have along its entire longitudinal direction substantially the same thickness as further sealings of the first gasket and/or further sealings of the second gasket.

[0019] In a further advantageous embodiment, the first sealing of the first gasket and the second sealing of the second gasket are arranged on top of each other in the stacking direction. In this way, they can be arranged in one line above each other. Forces can thus be reliably supported and/or derived by means of the sealings. Furthermore, leakage can be counteracted. Moreover, gaps between layers and within a layer can be avoided or sealed in a reliable way. Additionally, a load of stacked layers can be transferred reliably and safely to a stable part of the stack. Impairment of intermediate layers can be counteracted. Further, this enables a stable stack structure.

[0020] Preferably, the recess of the first gasket is configured to accommodate a further part of the corresponding layer as well as the recess of the second gasket is configured to accommodate a further part of the corresponding layer. For example, the recess is configured to accommodate a gas diffusion layer or a porous transport layer of said stack. Said recess of the first gasket is advantageously framed by the first sealing which has a thickness that is larger than a thickness of the second sealing of the second gasket framing the recess of the base plate of the second gasket configured to accommodate the further part of the layer. In particular, recesses of different gaskets, configured to accommodate the further part of a corresponding layer are arranged on top of each other in the stacking direction.

[0021] In particular, a space within said recess of the first gasket for accommodating the further part of the layer of said stack is smaller, measured in a direction substantially perpendicular to the stacking direction, than a space of said recess of the second gasket for accommodating the further part of the layer of said stack. In this way, a gas diffusion layer or porous transport layer having a larger extend in the direction substantially perpendicular to the stacking direction can be accommodated in the recess of the base plate of the second gasket compared to the corresponding recess of the base plate of the first gasket. In this way, a step between the end of the gas diffusion layer accommodated in the recess of the first gasket and the gas diffusion layer accommodated in the recess of the second gasket can be provided. By means of this step, the advantages of tolerating displacements of certain layers of the stack can be further improved.

[0022] In addition, a preferred embodiment of the electrolyzer provides that the gasket is arranged between two layers of the several layers of said stack and said two layers are spaced to the base plate through the sealing of the gasket. In this way, a weight of an adjacent layer can be carried by the corresponding elastomer sealing. In an advantageous version of the preferred embodiment, the second gasket is arranged between two further layers of the several layers of said stack and said two further layers are spaced to the base plate through the second sealing of the second gasket. In this way, an electrical separation between a base plate and directly adjacent layers is made possible. In this context, the gasket can be the first or the second gasket and the corresponding sealing can be the first or second sealing.

[0023] Preferably, the first gasket and/or the second gasket are each arranged directly adjacent to a layer of the stack which is designed as a membrane. Said membrane can be an ion-exchange membrane or a membrane electrode assembly. The membrane electrode assembly is in general an assembled stack of ion-exchange membranes, for example, comprising a proton-exchange membrane or an alkali-anion-exchange-membrane, a catalyst and/or a flat-plate-electrode. This makes it possible that a further part of the layer, for example the gas diffusion layer or the porous transport layer, can be accommodated in the first gasket or the second gasket in a reliable and safe way.

[0024] Advantageously, the gasket is arranged directly adjacent to a layer of the stack which is designed as a polar plate. In this context, the gasket can be the first or the second gasket. In particular, said polar plate is designed as a bipolar plate. The weight supported by the gasket can be directly conducted to the polar plate. This results in general in a stable structure of the stack. Further, an efficient and safe design of the electrolyzer can be provided.

[0025] Moreover, the invention provides a method for manufacturing the electroyzer according to the invention.

[0026] In the method for manufacturing, a first sealing framing a recess of a base plate of a first gasket of the electrolyzer is provided with a larger thickness compared to a thickness of a second sealing framing a recess of a base plate of a second gasket. In particular, the first sealing and the second sealing correspond to the first sealing and the second sealing described before.

[0027] By means of the enlarged first sealing, an alignment of the gasket in the stack of the electrolyzer can be hold at place. Further, a partly expanded elastomer sealing profile allows to counteract gaps that are formed within a layer. Accordingly, adjacent layers can be prevented from being unsupported. Consequently, impairment of a certain layer can be counteracted. Further, tolerance deviations relative to an opposing layer can be easily compensated. Additionally, by means of the enlarged thickness of the first sealing, an interference fit can be realized. In this way, the layers of the stack can be carefully tensed up. Additionally, a lateral displacement of separate layers of the stack relative to other layers of the same stack can be allowed within a predetermined range. Hence, a reliable and safe operation of an electrolyzer can be created.

[0028] In particular, said fist sealing of the gasket is provided with a larger thickness compared to a thickness of further sealings of the first gasket and/or the second gasket of the electrolyzer. This allows to simplify alignment of the layers of the stack of the electrolyzer in such that the layers can be held at a predetermined place and may move within a predetermined range. Especially, a uniform thickness of elastomer sealings used in the stack can be established.

[0029] This allows to manufacture an electrolyzer which is reliable and safe to operate. Further, a stable stack structure can be realized. In addition, an effort for maintenance, servicing or repair can be reduced. Moreover, damages or impairments due to displacements of certain layers can be counteracted. Also it is possible to avoid a lack of support and/or gaps. In addition, the electrolyzer can be easily designed and inexpensively manufactured in this way.

[0030] In a preferred embodiment of the method, said first sealing and said second sealing are arranged on top of each other in a stacking direction. This makes a manufacturing process easy to handle. Further, a stable and resilient electrolyser stack can be provided. Accordingly, a complexity of the manufacturing method can be kept low.

[0031] The properties, features and advantages of the invention described above, as well as the manner in which they are achieved, will be explained in more detail in connection with the figures in the following description of the embodiment of the invention. Where appropriate, the same reference signs are used in the figures for the same or corresponding elements of the invention. The examples serve to explain the invention and do not limit the invention to the combinations of features indicated therein, even with respect to functional features. Moreover, any of the features disclosed in the examples below may be considered in isolation and suitably combined

with the features of any of the above embodiments and their further aspects. The following illustrations are schematic drawings that are not to scale.

[0032] It shows:

FIG 1 an example of a gasket, provided as a metal-elastomer-gasket;

FIG 2 an example of a stack of an electrolyzer comprising two metal-elastomer-gaskets;

FIG 3 an illustration of an example of the method for manufacturing the example of the electrolyzer.

[0033] FIG 1 shows a schematic view of an example of a first gasket 20 which is provided for being arranged in a cell stack 12 of an electrolyzer 10, described in more detail in the context of FIG 2.

[0034] The first gasket 20 is provided for being part of a layer 14 of said stack 12 of the electrolyzer 10. In the present embodiment, the first gasket 20 comprises a metal base plate 22. Said base plate 22 has several recesses 24, 25. Exemplarily, one of the several recesses 24 is arranged central in the base plate 22. Said central recess 24 is configured to accommodate a further component 34 of the layer 14 of the stack 12. In the present example, said further component 34 can be a gas diffusion layer or a porous transport layer. Preferably, the further component 34 is provided as gas diffusion layer 34. Further recesses 25 of said several recesses 24, 25 are exemplarily provided for feeding fuels or draining reaction products of the electrolyzer 10. Additionally, the first gasket 20 comprises several elastomer sealings 26, 36. For each of the several recesses 24, 25 of the base plate 22 one of said sealings 26, 36 frames a complete circumference of one of these recesses 24, 25. Each of said sealings 26, 36 is positioned along a wall 38 of the base plate 22 which bounds a corresponding recess 24, 25 of the several recesses 24, 25.

[0035] As the elastomer sealings 26, 36, two kinds of sealings are provided in the present example. The first elastomer sealing 26 of the several sealings 26, 36 is provided as an enlarged sealing 26, which frames the central recess 24. This enlarged sealing 26 has a larger thickness than other sealings 36 of the several sealings 26, 36, which are framing remaining recesses 25 of the base plate 22 of the first gasket 20. In this context, a complete longitudinal direction of the enlarged sealing 26 is thicker than the other sealings 36 of the several sealings 26, 36. In the present example of the first gasket 20, the enlarged sealing 26 has a larger thickness along a complete longitudinal direction 32 than the other sealings 36 of the several sealings 26, 36 of the first gasket 20. Said longitudinal direction 32 extends exemplarily along the wall 38 bounding a corresponding recess 24 of the several recesses 24 of the base plate 22.

[0036] FIG 2 shows an example of a part of an electrolyzer 10, which comprises the stack 12 having several layers 14, 16, 18. These several layers 14, 16, 18 are arranged in a stacking direction 28 above one another. The example of the electrolyzer 10 is shown in a compressed state.

[0037] In the present example of the stack 12, as a first layer a bipolar plate 18 is chosen. In stacking direction 28 above this bipolar plate 18 a layer 14 is provided comprising a first gasket 20. The first gasket 20 corresponds to the example described in the context with FIG 1. In this layer 14, further a gas diffusion layer 34 is accommodated in the central recess 24 of the base plate 22 of the first gasket 20. By means of the first gasket 20 and its enlarged elastomer sealing 26, the gas diffusion layer 34 is fixed in a predetermined position with regard to the stacking direction 28.

[0038] Directly adjacent to the first gasket 20 in the stack direction 28 a further layer 16 is arranged. This layer is exemplarily designed as a membrane 16. Said membrane 16 can be an ion-exchange membrane or a membrane electrode assembly. In the compressed state of the stack 12, this membrane 16 is supported by the part of the gas diffusion layer 34 and the sealings 26, 36 of the first gasket 20. As a result, no relevant gap between the gas diffusion layer 34 and the further layer 16 occurs. In addition, by means of the arrangement of the sealings 26, 36 a gap between the gas diffusion layer 34 and a corresponding sealing 26 can be tolerated, as no pressure can reach the gas diffusion layer 34. Above the membrane 16 a second gasket 30 is arranged. With the help of the membrane 16 the first gasket 20 and the second gasket 30 are spaced from each other.

[0039] The second gasket 30 has in accordance with the first gasket 20 a base plate 22 with several recesses 24, 25. These recesses 24, 25 are arranged in the stacking direction 28 above corresponding recesses 24, 25 of the first gasket 20. Additionally, the second gasket 30 has several elastomer sealings 36, each framing one of the several recesses 24, 25 of the second gasket 30 in a complete circumferential direction of a corresponding recess 24, 25. However, in difference to the first gasket 20, a central recess 24 of the base plate 22 of the second gasket 30 is framed by an elastomer sealing 36 which has a smaller thickness than the afore-said enlarged elastomer sealing 26 of the first gasket 20. In order to frame a corresponding recess 24, 25 of the second gasket 30, said elastomer sealings 36 are connected to the base plate 22 in such that each of said several sealings 36 frames a complete circumference of a corresponding recess 24, 25. In particular, sealings 36 of the second gasket 30 framing one of the recesses 25 arranged eccentrically on the base plate 22, are designed in correspondence with sealings 36 of the first gasket 20 framing a corresponding recesses 25 arranged above or below one another in the stacking direction 28. In particular, the sealing 36 of the second gasket 30 framing the central recess 24 has along its entire longitudinal direction 32 substantially the same thickness as at least a part of non-enlarged sealings 36 of said first gasket 20

and/or the second gasket 30. However, the elastomer sealings 36 not framing the central recess 24 of the first or the second gasket 20, 30 can be designed variously.

[0040] In the present example, a maximal thickness of the enlarged sealing 26, measured in a direction substantially perpendicular to said stacking direction 28, is larger than a maximal thickness of the sealing 36 framing the central recess 24 of the second gasket 30, measured in said direction substantially perpendicular to the stacking direction 28. A form or a geometry of the other sealings 36 framing non-central recesses 25, can deviate from each other and from a form or a geometry of the enlarged sealing 26 of the first gasket 20. Exemplarily, the enlarged sealing 26 has a maximal thickness, measured in said direction that is at least 2-times larger than the sealings 36 framing the central recess 24 of the second gasket 30. Such a lateral expansion enables the avoidance of gaps. Unsupported parts of layers 14, 16, 18 can further be circumvented. Moreover, by means of a lateral expansion of the thickness of said enlarged sealing 26, compensation of geometric tolerances of other components of a corresponding layer 14, 16, 18 or the stack 12 can be realized.

[0041] In the compressed state of the stack 12, the example of the enlarged sealing 26 has substantially the same height as said other sealings 36 of the first gasket 20 and in particular as the sealings 36 of the second gasket 30. The height is measured in parallel to the stacking direction 28 and represents a maximal extension of a corresponding sealing 26, 36 in stacking direction 28. In this way, the stack 12 can be provided with substantially planar layers 14, 16, 18. It can be avoided that certain layers 14, 16, 18 are waved or bent. Accordingly, local pressures or stresses can be kept low. Nevertheless, the layers 14, 16, 18 can be fixed at place, for example by realizing an interference fit.

[0042] Finally, above the second gasket 30 a second bipolar plate 18 is arranged. This bipolar plate 18 is supported by the sealings 36 of the second gasket 30.

[0043] In a preferred version of the example of the stack 12 described in the context of FIG 2, the sealings 26, 36 of the first gasket 20 and of the second gasket 30 are aligned one above each other in stack direction 28. This allows to display forces resulting from weights of layers 14, 16, 18 in a direct manner against the stack direction 28 to the undermost bipolar plate 18. In this way, a load of stacked layers 14, 16, 18 can be transferred reliably and safely to a stable part of the stack 12. Impairment of intermediate layers 14, 16 can be counteracted. Further, this enables to provide a stable stack structure. In particular, gaps between different components of the same layer 14 can be avoided.

[0044] Preferably, the central recesses 24 of the first and the second gasket 20, 30 have the same dimensions. Accordingly, a space within said central recess 24 of the first gasket 20 for accommodating the gas diffusion layer 34 is smaller, measured in the direction substantially perpendicular to the stacking direction 28, than a space of the central recess 24 of the second gasket 30 for accommodating the gas diffusion layer 34. Accordingly, a gas diffusion layer 34 accommodated by the first gasket 20 is smaller than a gas diffusion layer 34 accommodated by the second gasket 30. In this way, a step between the two gas diffusion layers 34 occurs.

[0045] Additionally, the first gasket 20 and the second gasket 30 are each arranged between two layers 16, 18 of the several layers 14, 16, 18 of the stack 12. Through the enlarged sealing 26 of the first gasket 20 and the sealing 36 of the second gasket 30 as well as through further sealings 36, said two layers 16, 18 are spaced to the base plate 22 of a corresponding gasket 20, 30. A weight of layers 14, 16, 18 arranged above can thus be carried by the elastomer sealings 26, 36.

[0046] FIG 3 illustrates an example of a method 100 for manufacturing an electrolyzer 10. The present example of the method 100 describes exemplarily a manufacturing of an electrolyzer 10 which has been described in the context of FIG 2.

[0047] In the method 100 for manufacturing of the example of the electrolyzer 10, the enlarged sealing 26 of the several sealings 26, 36 framing each completely one of the several recesses 24, 25 of the base plate 22 of the first gasket 20 is provided with a larger thickness 102 compared to a thickness of the second sealing 36 framing the central recess 24 of the base plate 22 of the second gasket 30. By means of the enlarged sealing 26 of the first gasket 20, at least an alignment of the first gasket 20 in the stack 12 can be hold at place. Further, a displacement of the second gasket 30 can be tolerated within a predetermined range. Preferably, by means of the enlarged sealing 24 all layers 14, 16, 18 of the stack 12 can be hold at place. In addition, the partly expanded sealing profile of the enlarged sealing 26 allows to counteract gaps formed within the layer 14. Accordingly, an adjacent membrane 16 can be prevented from being unsupported and thus being impaired. By means of the enlarged thickness of the enlarged sealing 26, an interference fit can be realized. In this way, the layers 12, 14, 16 of the stack 12 can be carefully tensed up. Accordingly, a lateral displacement of separate layers 12, 14, 16 of the stack 12 relative to other layers 12, 14, 16 of the same stack 12 can be tolerated within a predetermined range. Hence, a reliable and safe operation of an electrolyzer 10 can be created.

[0048] Preferably, the enlarged sealing 26 of the first gasket 20 is provided with a larger thickness 102 compared to a thickness of all other sealings 36 framing a recess 25 of said first gasket 20 and all sealings 36 framing a recess 24, 25 of the second gasket 30.

[0049] In the present example of the method 100, also the alignment of the second gasket 30 of the stack 12 of the example of the electrolyzer 10 is hold at place by means of the one enlarged sealing 26 of the first gasket 20. This is exemplarily realized by providing 104 the enlarged sealing 26 of the first gasket 20 with a thickness which is larger than the thickness of the sealings 36 of the second gasket 30. Already by means of said one en-

larged sealing 26 an alignment of all layers 14, 16, 18 of the stack 12 of the electrolyzer 10 are hold at a predetermined position.

[0050] Further, in the present example of the method 100 the stack 12 is manufactured in such that said first sealing 26 and said second sealing 36 are arranged on top of each other in a stacking direction 28 106. In this way, the manufacturing method can be simplified and accelerated. Standard components can be used. Therefore, costs can be saved.

[0051] Although the invention has been further illustrated and described in detail by the above examples, the invention is not limited by the disclosed examples, and other variations may be derived therefrom by those skilled in the art without departing from the scope of the invention.

[0052] Independent of the grammatical term usage, individuals with male, female or other gender identities are included within the term.

Claims

1. Electrolyzer (10) comprising

- several layers (14, 16, 18) arranged as a stack (12);
- a first gasket (20) being part of one of the several layers (14, 16, 18), having a base plate (22) with a recess (24);
- a first elastomer sealing (26) connected to the base plate (22) of the first gasket (20) in such that it frames the recess (24) of said base plate (22);
- a second gasket (30) being part of a further of the several layers (14, 16, 18) and having a base plate (22) with a recess (24);
- a second elastomer sealing (36) connected to the base plate (22) of the second gasket (30) in such that it frames the recess (24) of said base plate (22);
- wherein said first elastomer sealing (26) has a larger thickness than said second elastomer sealing (36).

2. Electrolyzer (10) according to claim 1,
characterized in that
said first sealing (26) has a thickness that is at least 1.5-times, preferably 2-times and in particular 2.5-times, larger than said second sealing (36).

3. Electrolyzer according to claim 2,
characterized in that
a maximal thickness of said first sealing (26), measured in a direction transverse to a stacking direction (28) of said stack (12), preferably substantially perpendicular to said stacking direction (28), is larger than a maximal thickness of said second sealing (36) measured in the same direction.

4. Electrolyzer (10) according to one of the preceding claims,
characterized in that
in a compressed state of the stack (12), said first sealing (26) has a larger thickness in a direction substantially perpendicular to a stacking direction (28) than said second sealing (36).

5. Electrolyzer (10) according to claim 4,
characterized in that
in the compressed state of the stack (12), the further sealing (36) of the first gasket (20) has substantially the same thickness as said second sealing (36) of the second gasket (30), measured in stacking direction (28).

6. Electrolyzer (10) according to one of the preceding claims,
characterized in that

- said first sealing (26) frames a central recess (24) of the base plate (22) of the first gasket (20);
- said second sealing (36) frames a central recess (24) of the base plate (22) of the second gasket (30).

7. Electrolyzer (10) according to one of the preceding claims,
characterized in that
the second sealing (36) of the second gasket (30) has along its entire longitudinal direction (32) a smaller thickness than said first sealing (26) of the first gasket (20).

8. Electrolyzer (10) according to one of the preceding claims,
characterized in that
the first sealing (26) of the first gasket (20) and the second sealing (36) of the second gasket (30) are arranged on top of each other in the stacking direction (28).

9. Electrolyzer (10) according to one of the preceding claims,
characterized in that

- the recess (24) of the first gasket (20) is configured to accommodate a further part (34) of the layer (14) of said stack (12), preferably a gas diffusion layer or a porous transport layer;
- the recess (24) of the second gasket (20) is configured to accommodate a further part (34) of the layer (14) of said stack (12), preferably a gas diffusion layer or a porous transport layer.

10. Electrolyzer (10) according to claim 9,

characterized in that
a space within said recess (24) of the first gasket (20) for accommodating the further part (34) of the layer (14) of said stack (12) is smaller, measured in a direction substantially perpendicular to the stacking direction (28), than a space of said recess (24) of the second gasket (30) for accommodating the further part (34) of the layer (14) of said stack (12).

11. Electrolyzer (10) according to one of the preceding claims,
characterized in that

- the first gasket (20) is arranged between two layers (16, 18) of the several layers (14, 16, 18) of said stack (12) and said two layers (16, 18) are spaced to the base plate (22) through said first sealing (26) of the first gasket (20);
- the second gasket (30) is arranged between two layers (16, 18) of the several layers (14, 16, 18) of said stack (12) and said two layers (16, 18) are spaced to the base plate (22) through the second sealing (36) of the second gasket (30).

12. Electrolyzer (10) according to one of the preceding claims,
characterized in that
the first gasket (20) and/or the second gasket (30) are each arranged directly adjacent to a layer (16) of the stack (12) which is designed as a membrane, for example an ion-exchange membrane or a membrane electrode assembly.

13. Electrolyzer (10) according to one of the preceding claims,
characterized in that
the first gasket (20) and/or the second gasket (30) each is arranged directly adjacent to a layer (18) of the stack (12) which is designed as a polar plate, in particular as a bipolar plate.

14. Method (100) for manufacturing an electrolyzer (10) according to one of the preceding claims,
characterized in that
a first sealing (26) of a gasket (20) of the electrolyzer (10) is provided with a larger thickness (102) compared to a thickness of a second sealing (36) of a second gasket (30) (104).

15. Method (100) according claim 14,
characterized in that
said first sealing (26) and said second sealing (36) are arranged on top of each other in a stacking direction (28) (106).

FIG 1

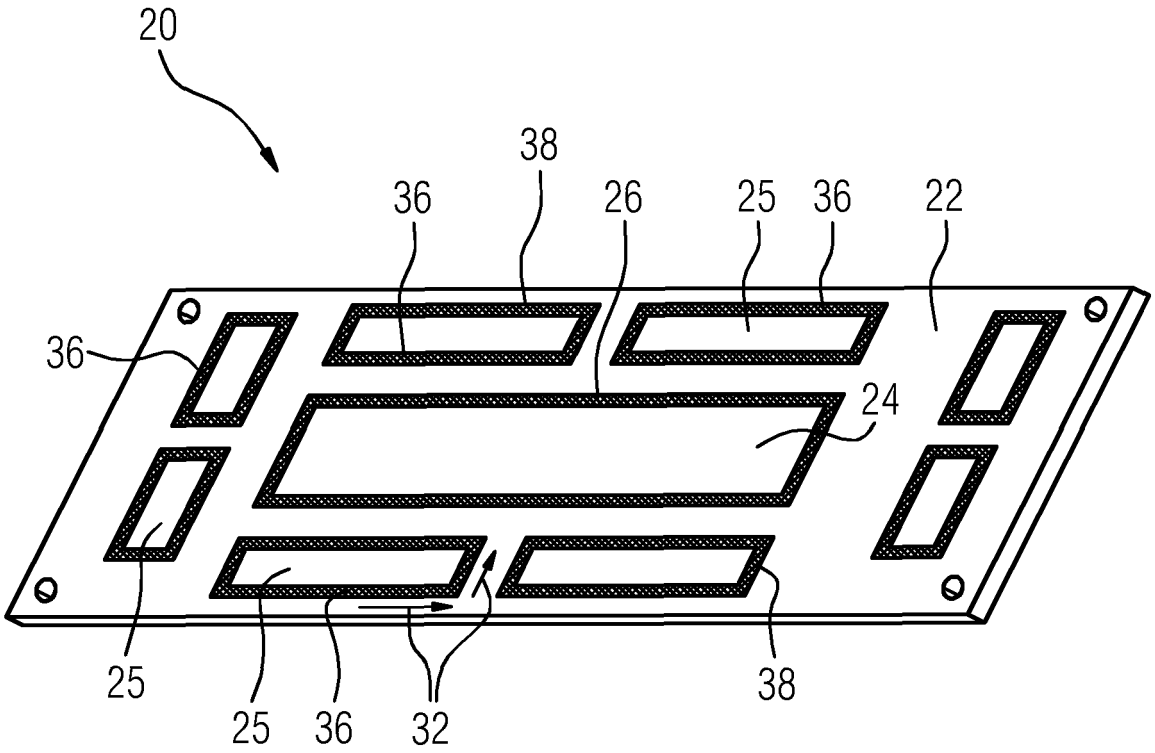


FIG 2

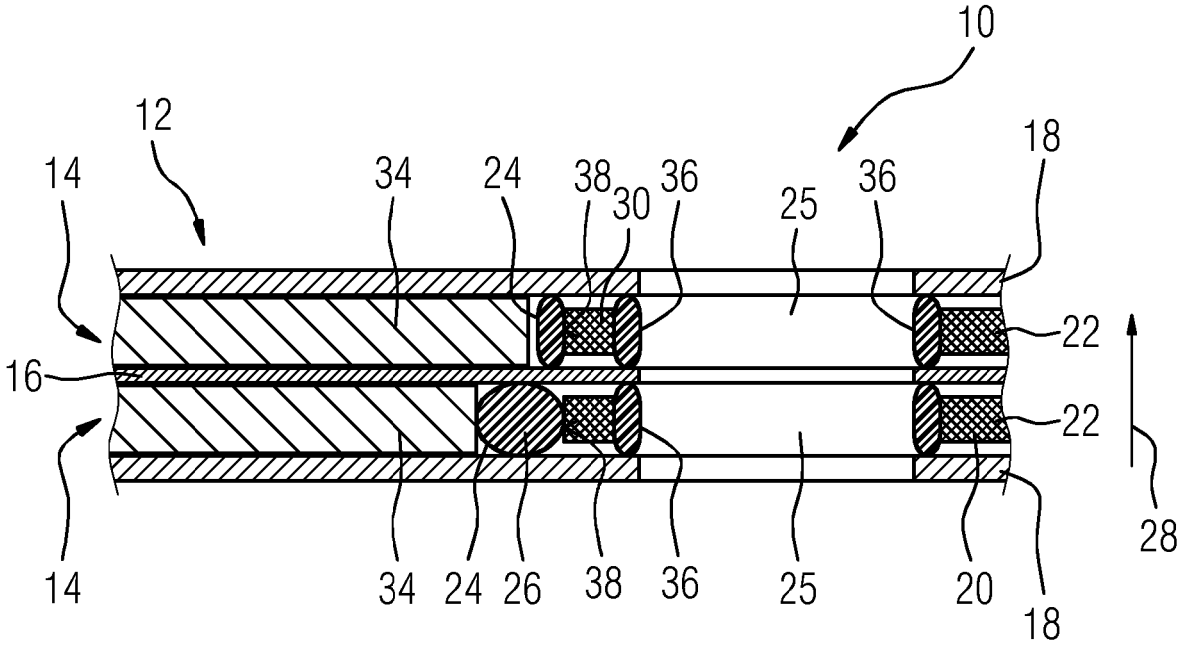
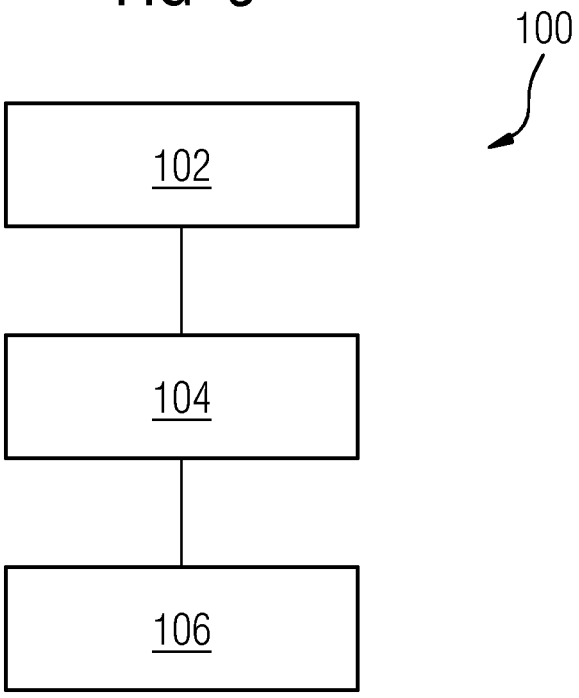

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FIG 3


100
102
104
106

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EUROPEAN SEARCH REPORT

Application Number
EP 25 16 8052

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 October 2025	Lange, Ronny

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