Description

Many manufacturing processes require the use of pure inert gases such as the rare or noble gases, helium, neon, argon, krypton, xenon or nitrogen. One particular example of their use is in the manufacture of semiconductor devices. Before use impure inert gases must be purified by removing contaminant gases such as CO, CO_2, CH_4, O_2 and H_2. GB-A-2,177,079 and GB-A-2,177,080 describe methods for the purification of inert gases to remove these impurity gases. However these two GB Patent Application Publications give no information relative to the problems of the maintenance of extremely low levels of hydrogen. US-A-4 306 887 and US-A-4 312 669 as well as BE-A-792 561 disclose various sorbing materials, also in the presence of H_2, but they do not teach how to reach a hydrogen partial pressure of 10^{-3} Pascal or less, as required in applications to semiconductor industry.

Although there is no quantitative measure available which relates the percentage of defects found during the manufacture of semiconductor devices with the partial pressure of hydrogen present during the manufacturing process, it is generally believed that the lower the hydrogen partial pressure, the lower the number of defects found.

It is therefore an object of the present invention to provide an improved apparatus for the removal of impurity gases from impure inert gases such as rare gases and nitrogen.

It is another object of the present invention to provide an apparatus for the purification of inert gases which ensures that the purified inert gas has an extremely low level of hydrogen.

It is yet another object of the present invention to provide a process for the removal of impurity gases from impure inert gases while ensuring an extremely low level of hydrogen in the purified outlet gas.

These and other objects and advantages of the present invention will become evident to those skilled in the art with reference to the following drawings and descriptions wherein;

Fig. 1 is a partially cutaway cross section of an apparatus of the present invention for the removal of impurity gases from inert gases which ensures that the purified gas has an extremely low level of hydrogen.

Fig. 2 is a graph showing the concentration of the impurity CO as distributed throughout the apparatus shown in Fig. 1 after said apparatus has been purifying inert gas for a certain period of time.

Fig. 3 is a graph having a curve similar to that of Fig. 2 but shows the concentration of the hydrogen impurity.

Fig. 4 is a graph showing the partial pressure of hydrogen throughout the apparatus of Fig. 1.

Fig. 5 is a graph showing the H_2 partial pressure in a purified inert gas of a prior art purifier and a purifier of the present invention.

The apparatus and the process for the removal of impurity gases from impure inert gases have the features of appended claims 1 and 5 and are herebelow described.

Referring now to the drawings and in particular to Fig. 1 there is shown a gas purification apparatus 100 for the removal of impurity gases from inert gases. By inert gases is meant the rare or noble gases helium, neon, argon, krypton and xenon as well as nitrogen. Gas purification apparatus 100 comprises a housing 102 in the form of a cylindrical sheath 104, which is preferably of a metal such as stainless steel. Cylindrical sheath 104 is provided with end caps 106, 106′ which are attached thereto in a gas tight manner. End caps 106, 106′ are again preferably of stainless steel. End cap 106 has attached thereto an inert gas inlet 108 in the form of hollow cylinder, again preferably of stainless steel. End cap 106′ is provided with a purified inert gas outlet 110. Gas outlet 110 is again in the form of a cylinder and preferably made of stainless steel. Cylindrical sheath 104 and end caps 106, 106′ define a hollow space 112 which contains a first gas sorbing material 114 and a second gas sorbing material 116. The first gas sorbing material 114 is preferably a non-evaporable getter alloy chosen from the group consisting of

a) an alloy of Zr-V-Fe and;

b) an alloy of Zr-Fe.

Said first gas sorbing material 114 should consist of a powder having an average particle size of less than about 125 µm in the form of a multiplicity of pellets formed by compressing and/or thermally sintering the powder. These pellets of first gas sorbing material 114 are located in a first region 118 adjacent to inert gas inlet 104. If the gas to be purified is a rare or noble gas such as argon then the first gas sorbing material 114 should be an alloy of Zr-V-Fe. In this case the first gas sorbing material is a non-evaporable getter alloy of Zr-V-Fe whose weight composition is such that percentages by weight of the three elements when plotted on a ternary composition diagram, lie within a polygon having as its corners the points defined by:

a) 75% Zr - 20% V - 5% Fe;

b) 45% Zr - 20% V - 35% Fe;

c) 45% Zr - 50% V - 5% Fe.

If the inert gas to be purified is nitrogen then the first gas sorbing material 114 is a non-evaporable getter alloy of Zr-Fe and preferably consists of from 15 to 30% by weight of Fe, balance Zr.

The second gas sorbing material 116 is a non-evaporable getter alloy having a composition 5-30% by weight Al, balance Zr. The second gas sorbing material 116 is in the form of pellets of compressed powder, the powder having an average particle size of less than 125 µm, said pellets being located in the housing in a second region 120 adjacent to purified inert gas outlet 110.

The process of the present invention for the removal of impurity gases from impure inert gas and ensuring an extremely low level of hydrogen in the purified outlet gas comprises the steps of passing the impure inert gas through an inlet to a housing and contacting the impure inert gas with the first gas sorbing material chosen from the group consisting of:

a) a non-evaporable getter alloy of Zr-V-Fe, and;

B) a non-evaporable getter alloy of Zr-Fe,

to produce a purified inert gas. The purified inert gas is then passed through and contacts a second gas sorbing material to produce a purified inert gas having an extremely low level of hydrogen. The second gas sorbing material 116 is a non-evaporable getter alloy having a composition 5 to 30% by weight aluminium balance zirconium. The purified inert gas having an extremely low level of hydrogen then passes through the purified inert gas outlet 110.

EXAMPLE 1

This example is not representative of the present invention but has been designed to aid in the understanding of the present invention.

An inert gas purification apparatus comprising a stainless steel housing of 7 cm length and 1 cm diameter, provided with an inert gas inlet and an inert gas outlet was filled with pellets of compressed powder of Zr_2Fe having a particle size less than 125 µm. The pellets were cylindrical in shape having a diameter of 4 mm and a height of 3 mm. The total weight of pellets used was 14 g. The apparatus was heated to 330 °C and impure N_2 gas was allowed to flow through the apparatus.

The impurity levels of the nitrogen gas were as follows:

IMPURITY LEVELS ppm					
	O_2	CH_4	H_2	CO	CO_2
A	10	10	9		9
B	9	8.5	7.5	9.5	
C	9	9	8.5	8.5	

A, B and C are arbitrary identification letters for successive cylinders of impure N_2 gas used in the present example. After a total of about 350 hours of flowing impure N_2 gas through the apparatus, samples of the Zr_2Fe were taken at various positions along the length of the apparatus and analyzed for their content of C , O_2, N_2 and H_2.

Fig. 2 shows the results of the C content measurements plotting the C content in cm^3 Pascal.mg^{-1} on the y axis as a function of position 1 in cm of the sample from the inert gas inlet 108.

Fig. 3 is a similar curve for H_2.

Fig. 4 shows the expected profile of the hydrogen partial pressure within the apparatus. This example shows that sorption of the impurities takes place in a progressive manner through the apparatus.

EXAMPLE 2

This example is not representative of the present invention but has been designed to aid in the understanding of the present invention.

An apparatus similar to that of Fig. 1 was filled with 720g of pellets of compressed powder of 70% Zr - 24.6% V - 5.4% Fe having a particle size less than 125 µm. The pellets were cylindrical in shape having a diameter of 6 mm and a height of 4 mm.

Argon gas of five nines declared purity was passed through the apparatus held at a fixed temperature, at an inlet pressure of 1.3 10^5 Pascal and an outlet pressure of $1 \cdot 10^5$ Pascal. The Ar gas flow was 1 litre

min^{-1}. After approximately 1 hour the H_2 partial pressure was measured and plotted on the graph of Fig. 5. The temperature was changed and the test repeated.

The points were plotted for the temperatures 300 °C, 350 °C, 400 °C and 450 °C leading to line A on Fig. 5.

EXAMPLE 3

This example represents the present invention.

Example 2 was repeated except that a portion of the housing adjacent to the gas inlet was filled with 650 g of Zr-V-Fe pellets identical to those used in Example 2. The remaining space adjacent the gas outlet was filled with 70 g of identical sized pellets of 95% by weight of 84% Zr - 16% Al alloy of particle size less than 125 µm intimately mixed with 5% by weight of Al powder and compressed. The test was repeated as for Example 2 at 400 °C and 450 °C. During each test the Zr-V-Fe alloy and the Zr-Al alloy were at the same temperature. The results are shown as line B on Fig. 5.

As can be seen the resulting hydrogen impurity level of the outlet gas has been reduced by two orders of magnitude i.e., by a factor of 100.

EXAMPLE 4

Examples 2 and 3 are repeated except that the Zr-V-Fe pellets are replaced by pellets of Zr_2Fe and the gas to be purified is N_2. The outlet partial pressure of H_2 is considerably reduced when Zr-Al pellets are present adjacent the purified gas outlet.

Claims

1. An apparatus for the removal of impurity gases, comprising hydrogen, from impure inert gases comprising an impure inert gas inlet (108) in fluid communication with a housing (102) containing a first gas sorbing material (114) and a second gas sorbing material (116), said housing being in fluid communication with a purified gas outlet (110), characterized by the fact that:
   A. the first gas sorbing material (114) is chosen from the group consisting of:
      a) a non-evaporable getter alloy of Zr-V-Fe
      b) Zr-Fe,
   and
   B. the second gas sorbing material (116) is a non-evaporable getter alloy having a composition 5-30% Al balance Zr.

2. An apparatus according to claim 1, wherein said inert impure gas is argon, characterized by the fact that:
   A. The first gas sorbing material (114) is a non-evaporable getter alloy of Zr-V-Fe whose weight composition is such that percentages by weight of the three elements, when plotted on a ternary composition diagram, lie within a polygon having as its corners the points defined by:
      a) 75% Zr - 20% V - 5% Fe
      b) 45% Zr - 20% V - 35% Fe
      c) 45% Zr - 50% V - 5% Fe
   and
   B. the second gas sorbing material is a non-evaporable getter alloy having a composition of 16% Al balance Zr.

3. An apparatus according to claim 1, wherein said inert impure gas is nitrogen, characterized by the fact that:
   A. the first gas sorbing material (114) is a non-evaporable getter alloy consisting of from 15 to 30% by weight of Fe, balance Zr, and
   B. the second gas sorbing material (116) is a non-evaporable getter alloy having a composition of 16% Al balance Zr.

4. An apparatus according to claim 1, characterized by the fact that:
   A. the first gas sorbing material (114) is in the form of a multiplicity of pellets of compressed powder the powder having an average particle size of less than 125 µm, said pellets being located in the

min^{-1}. After approximately 1 hour the H_2 partial pressure was measured and plotted on the graph of Fig. 5. The temperature was changed and the test repeated.

The points were plotted for the temperatures 300 °C, 350 °C, 400 °C and 450 °C leading to line A on Fig. 5.

EXAMPLE 3

This example represents the present invention.

Example 2 was repeated except that a portion of the housing adjacent to the gas inlet was filled with 650 g of Zr-V-Fe pellets identical to those used in Example 2. The remaining space adjacent the gas outlet was filled with 70 g of identical sized pellets of 95% by weight of 84% Zr - 16% Al alloy of particle size less than 125 µm intimately mixed with 5% by weight of Al powder and compressed. The test was repeated as for Example 2 at 400 °C and 450 °C. During each test the Zr-V-Fe alloy and the Zr-Al alloy were at the same temperature. The results are shown as line B on Fig. 5.

As can be seen the resulting hydrogen impurity level of the outlet gas has been reduced by two orders of magnitude i.e., by a factor of 100.

EXAMPLE 4

Examples 2 and 3 are repeated except that the Zr-V-Fe pellets are replaced by pellets of Zr_2Fe and the gas to be purified is N_2. The outlet partial pressure of H_2 is considerably reduced when Zr-Al pellets are present adjacent the purified gas outlet.

Claims

1. An apparatus for the removal of impurity gases, comprising hydrogen, from impure inert gases comprising an impure inert gas inlet (108) in fluid communication with a housing (102) containing a first gas sorbing material (114) and a second gas sorbing material (116), said housing being in fluid communication with a purified gas outlet (110), characterized by the fact that:
   A. the first gas sorbing material (114) is chosen from the group consisting of:
      a) a non-evaporable getter alloy of Zr-V-Fe
      b) Zr-Fe,
   and
   B. the second gas sorbing material (116) is a non-evaporable getter alloy having a composition 5-30% Al balance Zr.

2. An apparatus according to claim 1, wherein said inert impure gas is argon, characterized by the fact that:
   A. The first gas sorbing material (114) is a non-evaporable getter alloy of Zr-V-Fe whose weight composition is such that percentages by weight of the three elements, when plotted on a ternary composition diagram, lie within a polygon having as its corners the points defined by:
      a) 75% Zr - 20% V - 5% Fe
      b) 45% Zr - 20% V - 35% Fe
      c) 45% Zr - 50% V - 5% Fe
   and
   B. the second gas sorbing material is a non-evaporable getter alloy having a composition of 16% Al balance Zr.

3. An apparatus according to claim 1, wherein said inert impure gas is nitrogen, characterized by the fact that:
   A. the first gas sorbing material (114) is a non-evaporable getter alloy consisting of from 15 to 30% by weight of Fe, balance Zr, and
   B. the second gas sorbing material (116) is a non-evaporable getter alloy having a composition of 16% Al balance Zr.

4. An apparatus according to claim 1, characterized by the fact that:
   A. the first gas sorbing material (114) is in the form of a multiplicity of pellets of compressed powder the powder having an average particle size of less than 125 µm, said pellets being located in the

housing (102) in a region (118) near to said inert gas inlet (108),
and
B. the second gas sorbing material (116) is in the form of pellets of compressed powder the powder having an average particle size of less than 125 µm, said pellets being located in the housing (102) in a region (120) near to said purified inert gas outlet (110).

5. A process for the removal of impurity gases, comprising hydrogen, from impure inert gases and ensuring an extremely low level of hydrogen in the purified outlet gas, characterized by comprising the steps of:
A. passing the impure inert gas through an inlet to a housing,
B. contacting the impure inert gas with a first gas sorbing material chosen from the group consisting of
a) a non-evaporable getter alloy of Zr-V-Fe,
b) Zr-Fe,
to produce a purified inert gas,
C. passing the purified inert gas through a secod gas sorbing material to produce a purified inert gas having an extremely low level of hydrogen said second gas sorbing material being a non-evaporable getter alloy having a composition 5-30% Al balance Zr, and
D. passing the purified inert gas having an extremely low level of hydrogen through a purified gas outlet.

6. A process of claim 5 in which the gas to be purified is argon and the first gas sorbing material is a non-evaporable getter of Zr-V-Fe whose weight composition is such that the percentages by weight of the three elements, when plotted on a ternary composition diagram, lie within a polygon having as its corners the points defined by:
a) 75% Zr - 20% V- 5% Fe
b) 45% Zr - 20% V - 35% Fe
c) 45% Zr - 50% V - 5% Fe.

7. A process of claim 5 in which the gas to be purified is nitrogen and the first gas sorbing material is a non-evaporable getter alloy consisting of from 15 to 30% by weight of Fe, balance Zr.

8. A process of claim 5 in which the second gas sorbing material is a non-evaporable getter alloy having a composition of 16% Al balance Zr.

9. A process according to claim 6, wherein said first gas sorbing material is in the form of multiplicity of pellets of compressed powder the powder having an average particle size of less than 125 µm, said pellets being located in the housing in a region near to said inert gas inlet, and being maintained at a temperature of from 350 °C to 450 °C; and
said second gas sorbing material is in the form of a multiplicity of pellets of compressed powder the powder having an average particle size of less than 125 µm, said pellets being located in the housing in a region near to said purified inert gas outlet, and being maintained at a temperature substantially equal to that of the first gas sorbing material.

Patentansprüche

1. Einrichtung zur Entfernung von gasförmigen Verunreinigungen einschließlich Wasserstoff aus unreinen Inertgasen, enthaltend einen Einlaß (108) für das unreine Inertgas, der in strömender Verbindung mit einem Gehäuse (102) steht, enthaltend ein erstes gassorbierendes Material (114) und ein zweites gassorbierendes Material (116), wobei das Gehäuse in strömender Verbindung mit dem Auslaß (110) für das gereinigte Gas steht, dadurch gekennzeichnet, daß
A. ein erstes gassorbierendes Material (114) ausgewählt ist aus der aus
a) einer nicht verdampfbaren Getter-Legierung aus Zr-V-Fe,
b) Zr-Fe
bestehenden Gruppe und
B. das zweite gassorbierende Material (116) eine nicht verdampfbare Getter-Legierung mit einer Zusammensetzung von 5 bis 30 % Al und dem Rest Zr ist.

* C L M S *

2. Einrichtung nach Anspruch 1, worin das unreine Inertgas Argon ist, dadurch gekennzeichnet, daß
   A. das erste gassorbierende Material 114 eine nicht verdampfbare Getter-Legierung von Zr-V-Fe ist, deren Gewichtzusammensetzung derart ist, daß beim Zeichnen des Diagramms einer ternären Zusammensetzung die Gewichtsprozente dieser drei Elemente innerhalb eines Polygons liegen, dessen Ecken durch folgende Punkte definiert sind:
      a) 75% Zr - 20% V - 5% Fe
      b) 45% Zr - 20% V - 35% Fe
      c) 45% Zr - 50% V - 5% Fe und
   B. das zweite gassorbierende Material eine nicht verdampfbare Getter-Legierung einer Zusammensetzung von 16% Al und dem Rest Zr ist.

3. Einrichtung nach Anspruch 1, worin das unreine Inertgas Stickstoff ist, dadurch gekennzeichnet, daß
   A. das erste gassorbierende Material (114) eine aus 13 bis 30 Gew.% Fe und dem Rest Zr bestehende nicht verdampfbare Getter-Legierung ist und
   B. das zweite gassorbierende Material (116) eine nicht verdampfbare Getter-Legierung einer Zusammensetzung von 16% Al und dem Rest Zr ist.

4. Einrichtung nach Anspruch 1, dadurch gekennzeichnet, daß
   A. das erste gassorbierende Material (114) in Form einer Vielzahl von Pellets eines verpreßten Pulvers mit einer mittleren Teilchengröße von kleiner als 125 µm vorliegt, wobei die Pellets in dem Gehäuse (102) in einem Bereich (118) nahe dem Einlaß (118) des Inertgases angeordnet sind, und
   B. das zweite gassorbierende Material (116) in Form von Pellets eines verpreßten Pulvers einer mittleren Teilchengröße von kleiner als 125 µm vorliegt, wobei die Pellets in dem Gehäuse (102) in einem Bereich (120) nahe dem Auslaß des gereinigten Inertgases angeordnet sind.

5. Verfahren zur Beseitigung von gasförmigen Verunreinigungen, enthaltend Wasserstoff aus unreinen Inertgasen und zur Sicherung eines äußerst geringen Wasserstoffgehalts in dem gereinigten abströmenden Gas, gekennzeichnet durch
   A. Einströmen des unreinen Inertgases durch einen Einlaß in das Gehäuse,
   B. in Berührung bringen des unreinen Inertgases mit einem ersten gassorbierenden Material, ausgewählt aus der aus
      a) einer nicht verdampfbaren Getter-Legierung aus Zr-V-Fe,
      b) Zr-Fe
   bestehenden Gruppe, zur Herstellung eines gereinigten Inertgases,
   C. Durchströmen des gereinigten Inertgases durch ein zweites gassorbierendes Material zur Herstellung eines gereinigten Inertgases mit einem äußerst geringen Wasserstoffgehalt, wobei das zweite gassorbierende Material eine nicht verdampfbare Getter-Legierung einer Zusammensetzung von 5 bis 30% Aluminium und dem Rest Zr ist und
   D. Ausströmen des gereinigten Inertgases mit einem äußerst geringen Wasserstoffgehalt durch einen Auslaß für das gereinigte Gas.

6. Verfahren nach Anspruch 5, in dem das zu reinigende Gas Argon ist und das erste gassorbierende Material eine nicht verdampfbare Getter aus Zr-V-Fe, dessen Gewichtszusammensetzung derart ausgewählt ist, daß beim Zeichnen eines Diagramms einer ternären Zusammensetzung die Gewichtsprozente der drei Elemente innerhalb eines Polygons liegen, das durch die folgenden Eckpunkte definiert ist
   a) 75% Zr - 20% V - 5% Fe
   b) 45% Zr - 20% V - 35% Fe
   c) 45% Zr - 50% V - 5% Fe.

7. Verfahren nach Anspruch 5, in dem das zu reinigende Gas Stickstoff ist und das erste gassorbierende Material eine nicht verdampfbare Getter-Legierung, die aus 15 bis 30 Gew.% Fe und dem Rest Zr besteht.

8. Verfahren nach Anspruch 5, in dem das zweite gassorbierende Material eine Getter-Legierung der Zusammensetzung 16% Al und dem Rest Zr ist.

9. Verfahren nach Anspruch 6, worin das erste gassorbierende Material in Form einer Vielzahl von Pellets aus verpreßtem Pulver besteht und das Pulver eine mittlere Teilchengröße von weniger als 125 µm hat,

wobei die Pellets in dem Gehäuse in einem Bereich nahe dem Einlaß des Inertgases angeordnet sind und eine Temperatur von 350 bis 450 °C aufrechterhalten wird und
das zweite gassorbierende Material in Form einer Vielfalt von Pellets aus verpreßtem Pulver besteht und das Pulver eine mittlere Teilchengröße von kleiner als 125µm aufweist, wobei diese Pellets im Gehäuse in einem Bereich nahe dem Auslaß für das gereinigte Inertgas angeordnet sind und auf einer Temperatur gehalten werden, die im wesentlichen gleich der des ersten gassorbierenden Materials ist.

Revendications

1. Appareil pour éliminer des impuretés gazeuses comprenant de l'hydrogène, de gaz inertes impure comprenant une admission de gaz inerte (108) en communication fluide avec un boîtier (102) contenant un premier matériau de sorption de gaz (114) et un second matériau de sorption du gaz (116), ledit boîtier étant en communication fluide avec une sortie de gaz purifié (110), caractérisé en ce que :
   A. le premier matériau de sorption du gaz (114) est choisi dans le groupe se composant de :
      a) un alliage getter non évaporable de Zr-V-Fe
      b) Zr-Fe, et
   B. le second matériau de sorption du gaz (116) est un alliage getter non évaporable ayant une composition de 5 à 30 % de Al, le complément en Zr.

2. Appareil selon la revendication 1, dans lequel ledit gaz impur inerte est l'argon, caractérisé par le fait que :
   A. le premier matériau de sorption du gaz (114) est un alliage getter non évaporable de Zr-V-Fe dont la composition pondérale est telle que les pourcentages en poids des trois éléments, quand on les reporte sur un diagramme de composition ternaire, se trouve à l'intérieur d'un polygone ayant pour sommets les points définis par :
      a) 75 % de Zr-20 % de V-5 % de Fe
      b) 45 % de Zr-20 % de V-35 % de Fe
      c) 45 % de Zr-50 % de V-5 % de Fe et
   B. le second matériau de sorption du gaz est un alliage getter non évaporable ayant une composition de 16 % de Al, complément en Zr.

3. Appareil selon la revendication 1, dans lequel ledit gaz impur inerte est l'azote, caractérisé par la fait que :
   A. le premier matériau de sorption du gaz (114) est un alliage getter non évaporable comprenant de 15 à 30 % en poids de Fe, complément en Zr, et
   B. le second matériau de sorption du gaz (116) est un alliage getter non évaporable ayant une composition de 16 % Al, complément en Zr.

4. Appareil selon la revendication 1, caractérisé par le fait que :
   A. le premier matériau de sorption du gaz (114) est sous forme d'une multitude de granulés de poudre comprimée, la poudre ayant une granulométrie moyenne inférieure à 125 µm, lesdits granulés étant situés dans le boîtier (102) dans une zone (118) proche de ladite admission de gaz inerte (108), et
   B. le second matériau de sorption du gaz (116) est sous forme de granulés de poudre comprimée, la poudre ayant une granulométrie moyenne inférieure à 125 µm, les granulés étant situés dans le boîtier (102) dans une zone (120) proche de ladite sortie de gaz purifié (110).

5. Procédé pour l'élimination de gaz impurs, comprenant l'hydrogène, de gaz inertes impurs et pour assurer une teneur extrêmement faible en hydrogène à la sortie de gaz purifié, caractérisé par les étapes consistant :
   A. à faire passer le gaz inerte impur à travers une admission vers un boîtier.
   B. à mettre en contact le gaz impur inerte avec un premier matériau de sorption du gaz choisi dans le groupe se composant de
      a) un alliage getter non évaporable de Zr-V-Fe
      b) Zr-fe pour produire un gaz inerte purifié,
   C. à faire passer le gaz inerte purifié à travers un deuxième matériau de sorption du gaz pour produire un gaz inerte purifié ayant une teneur extrêmement faible en hydrogène, ledit second matériau de sorption du gaz étant un alliage getter non évaporable ayant une composition de 5 à 30

% de Al, le complément en Zr, et
D. à faire passer le gaz inerte purifié ayant une teneur extrêmement faible en hydrogène à travers une sortie de gaz purifié.

6. Procédé selon la revendication 5 dans lequel le gaz à purifier est l'argon, et le premier matériau de sorption du gaz est un getter non évaporable de Zr-V-Fe dont la composition en poids est telle que les pourcentages en poids des trois éléments, quand ils sont reportés sur un diagramme de composition ternaire, se trouvent à l'intérieur d'un polygone ayant comme côtés les points définis par :
   a) 75 % de Zr-20 % de V-5 % de Fe
   b) 45 % de Zr-20 % de V-35 % de Fe
   c) 45 % de Zr-50 % de V-5 % de Fe

7. Procédé selon la revendication 5, dans lequel le gaz à purifier est l'azote et le premier matériau de sorption du gaz est un alliage getter non évaporable se composant de 15 à 30 % en poids de Fe, le complément en Zr.

8. Procédé selon la revendication 5, dans lequel le second matériau de sorption du gaz est un alliage getter non évaporable ayant une composition de 16% de Al, le complément en Zr.

9. Procédé selon la revendication 6, dans lequel ledit premier matériau de sorption du gaz est sous forme d'une multitude de granulés de poudre comprimée, la poudre ayant une granulométrie moyenne inférieure à 125 µm, lesdits granulés étant situés dans le boîtier dans une zone proche de ladite admission de gaz inerte, et que l'on maintient à une température de 350 °C à 450 °C ; et
ledit second matériau de sorption du gaz est sous forme d'une multitude de granulés de poudre comprimée, la poudre ayant une granulométrie moyenne inférieure à 125 µm, lesdits granulés étant situés dans le boîtier dans une zone proche de la sortie dudit gaz purifié inerte, et que l'on maintient à une température pratiquement égale à celle du premier matériau de sorption du gaz.