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(54) **DEWAR ASSEMBLY AND MACHINING METHOD THEREFOR, AND DETECTION DEVICE**

(57) A Dewar assembly and a machining method therefor, and a detection device. The Dewar assembly includes a packaging device and a plurality of functional devices. The packaging device has a sealed cavity. The plurality of functional devices are all mounted in the sealed cavity. The packaging device and the plurality of functional devices are all non-getter-dedicated components. At least one of the plurality of functional devices serves as a bearing portion of a getter structure, and/or the packaging device serves as the bearing portion of the getter structure. The getter structure comprises a getter layer (300) disposed on at least part of a surface of the bearing portion that is in communication with the sealed cavity. The getter structure utilizes the getter layer (300) to absorb gas in the sealed cavity.

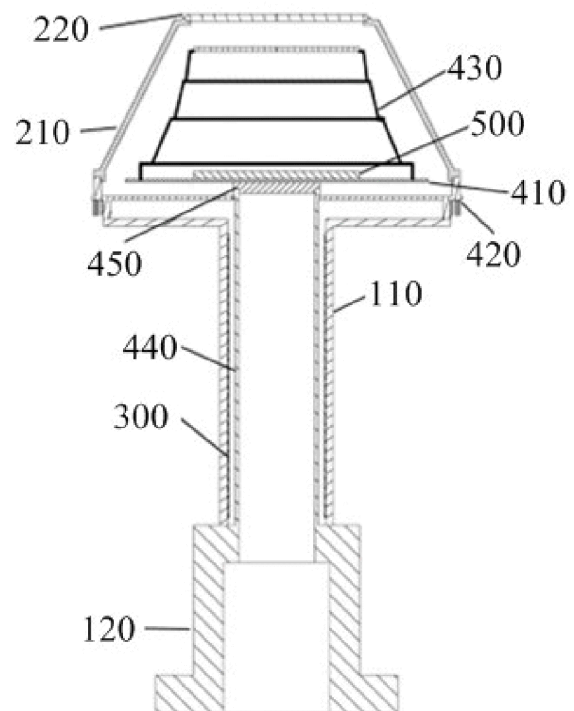


FIG. 1

Description

TECHNICAL FIELD

[0001] The present application belongs to the field of refrigeration equipment technology, and specifically relates to a Dewar assembly, a machining method therefor, and a detection device.

BACKGROUND

[0002] Low-temperature detectors such as infrared detectors are typically mounted on a Dewar assembly to utilize the Dewar assembly to provide a vacuum environment.

SUMMARY

[0003] In a first aspect, an embodiment of the present application discloses a Dewar assembly, including a packaging device and a plurality of functional devices, where the packaging device has a sealed cavity, the plurality of functional devices are all mounted in the sealed cavity, the packaging device and the plurality of functional devices are all non-getter-dedicated components, at least one of the plurality of functional devices serves as a bearing portion of a getter structure, and/or the packaging device serves as the bearing portion of the getter structure; the getter structure includes a getter layer on at least part of a surface of the bearing portion that is in communication with the sealed cavity, and the getter structure is configured to utilize the getter layer to absorb gas in the sealed cavity.

[0004] In a second aspect, the present application further discloses a machining method for a Dewar assembly, including: removing an oxide layer on a surface of a bearing portion to form a first intermediate, where the bearing portion includes at least one of a packaging device and a functional device; forming a passivation layer on a surface of the first intermediate to form a second intermediate; forming a getter layer on at least part of a surface of the second intermediate to form a getter structure.

[0005] In a third aspect, the present application further discloses a detection device, including a detector and the above-mentioned Dewar assembly, where the Dewar assembly includes a substrate, the substrate and the detector are both in the sealed cavity of the Dewar assembly, and the detector is mounted on the substrate.

[0006] An embodiment of the present application discloses a Dewar assembly, including a packaging device and functional devices in a sealed cavity of the packaging device. By having at least one of the packaging device and the functional devices serve as a bearing portion of a getter structure, and providing a getter layer on at least part of a surface of the bearing portion that is in communication with the sealed cavity, even if gas leaks into the Dewar assembly, the getter layer can be used to absorb

the gas, thereby providing relatively good sustainability of the vacuum environment of the Dewar assembly. Furthermore, by using basic components of the Dewar assembly, such as the packaging device and the functional devices, as the bearing portion for carrying the getter layer in the getter structure, there is no need to additionally arrange a component in the Dewar assembly for providing a bearing function for the getter layer, thereby making an overall size of the Dewar assembly relatively small, reducing the leak rate of the packaging device, and thus effectively reducing the difficulty of forming a vacuum environment in the Dewar assembly, achieving the purpose of improving the vacuum reliability of the Dewar assembly.

BRIEF DESCRIPTION OF DRAWINGS

[0007] The drawings described here are used to provide a further understanding of the present application and constitute a part of the present application. The illustrative embodiments of the present application and their descriptions are used to explain the present application and do not constitute an improper limitation of the present application.

FIG. 1 is a schematic structural diagram of a Dewar assembly according to embodiments of the present application.

FIG. 2 is a schematic structural diagram of a housing in a Dewar assembly according to embodiments of the present application.

FIG. 3 is a schematic structural diagram of a cover in a Dewar assembly according to embodiments of the present application.

FIG. 4 is a schematic structural diagram of a radiation shield in a Dewar assembly according to embodiments of the present application.

FIG. 5 is a flowchart of a machining method for a Dewar assembly according to embodiments of the present application.

[0008] Reference numerals: 110-housing, 120-base, 210-cover, 220-light entry component, 300-getter layer, 410-substrate, 420-lead frame, 430-radiation shield, 440-cold finger, 450-cold head, 500-detector.

DETAILED DESCRIPTION

[0009] The technical solutions in the embodiments of the present application will be described clearly and completely below with reference to the accompanying drawings in the embodiments of the present application. Obviously, the described embodiments are some, but not all, of the embodiments of the present application. Based on the embodiments in the present application, all other embodiments obtained by a person of ordinary skill in the art without making creative efforts fall within the protection scope of the present application.

[0010] The terms "first," "second," etc., in the description and claims of the present application are used to distinguish similar objects and are not used to describe a specific order or sequence. It should be understood that the data used in this way are interchangeable under appropriate circumstances such that the embodiments of the present application can be implemented in an order other than those illustrated or described herein. Moreover, the objects distinguished by "first," "second," etc., are usually of one type, and the number of objects is not limited. For example, the first object can be one or multiple. Furthermore, "and/or" in the description and claims indicates at least one of the connected objects, and the character "/" generally indicates that the associated objects before and after are in an "or" relationship.

[0011] To maintain the sustainability of its vacuum environment, current Dewar assemblies usually have a columnar or tubular getter structure inside the housing. The arrangement of these getter structures makes the size of the housing of the Dewar assembly relatively large. On the one hand, this further increases the difficulty of forming a vacuum environment inside the Dewar assembly; on the other hand, it also significantly increases the leak rate of the Dewar assembly, leading to relatively low vacuum reliability of current Dewar assemblies.

[0012] As shown in FIG. 1 to FIG. 4, an embodiment of the present application discloses a Dewar assembly, including a packaging device and a plurality of functional devices. The packaging device is a general term for structures in the Dewar assembly used to provide a packaging function. To facilitate machining and assembly, the packaging device can generally include a plurality of separately machined components, and during the assembly process of the Dewar assembly, the aforementioned plurality of components are connected to each other to form the packaging device used to provide mounting and protection functions for other components in the Dewar assembly. For example, the packaging device includes a housing 110, a base 120, a cover 210, and a light entry component 220. In other embodiments of the present application, the packaging device may also include other components, which are not limited herein. The housing 110 is mounted on the base 120, and the cover 210 is mounted on a side of the housing 110 facing away from the base 120.

[0013] In some embodiments, the housing 110, the base 120, and the cover 210 can all be formed using materials with relatively high structural strength, such as metal, to provide relatively reliable protection for other components inside the Dewar assembly and ensure the structural integrity of the packaging device of the Dewar assembly is relatively reliable. To ensure that the entire packaging device has a sealed space while also allowing external light to enter the Dewar assembly and be captured by components such as the detector 500 mounted inside the Dewar assembly, the light entry component 220 is formed using a light-transmitting material and is mounted at an end of the cover 210 facing away from the

housing 110.

[0014] Functional devices are a general term for components in the Dewar assembly used to provide corresponding functions. The number of functional devices can be multiple, and the specific number is not limited herein. For example, in the embodiment of the present application, the functional devices include a substrate 410, a lead frame 420, a radiation shield 430, and the like. As mentioned above, the packaging device has a sealed cavity. Based on this, respective functional devices are mounted in the sealed cavity. Furthermore, the Dewar assembly can be used to mount a low-temperature detector; therefore, the sealed cavity can also be used to accommodate the detector 500.

[0015] To facilitate power supply to the detector 500, as mentioned above, the functional devices include the substrate 410 and the lead frame 420. In some embodiments, the detector 500 is mounted on the substrate 410, the lead frame 420 is connected to the substrate 410, and a part of the lead frame 420 extends out of the housing 110. By connecting the lead frame 420 to an external power source or other equipment, normal operation of the detector 500 can be ensured.

[0016] For the Dewar assembly based on the above structure, to ensure relatively good vacuum sustainability of the Dewar assembly, a getter structure is provided in the Dewar assembly disclosed in the embodiment of the present application. Furthermore, when a small amount of gas is generated or penetrates into the sealed cavity of the Dewar assembly, the getter structure can be used to absorb the gas, thereby maintaining a relatively high vacuum degree in the sealed cavity of the Dewar assembly.

[0017] To prevent the introduction of additional components when providing the getter structure in the Dewar assembly, in the embodiment of the present application, the basic structure of the Dewar assembly can be used to form the getter structure. In the embodiment of the present application, one or several of the plurality of functional devices, and/or the packaging device can be used as the bearing portion of the getter structure. Since both the packaging device and the functional devices are basic structures used to form the Dewar assembly, by using one or several of them as the bearing structure for the getter layer (i.e., the bearing portion), it is possible to avoid additionally arranging other components for carrying the getter layer. Thus, under conditions where the number, structure, size, and other conditions of the functional devices remain unchanged, the size of the packaging device can be made relatively small. Consequently, the number of connection points such as weld seams connected to each other in the packaging device is reduced, and the size of the weld seams is smaller, thereby reducing the leak rate of the packaging device used to form the sealed cavity. When the size of the packaging device is relatively small, the size of the accommodating cavity formed by the packaging device is also relatively small, which can reduce the difficulty of forming a vacuum

environment in the sealed cavity.

[0018] In other words, in the embodiment of the present application, the packaging device and each functional device are all non-getter-dedicated components. That is, these two types of components are not only used to provide the function of absorbing gas in the Dewar assembly but also provide the function of absorbing gas while serving other purposes. As mentioned above, the packaging device has a sealed cavity, meaning that the packaging device in the Dewar assembly disclosed in the present application is used to provide a packaging function; of course, it can also provide other additional technical effects such as protection. For the sake of brevity, detailed description is omitted here. As for the plurality of functional devices, each functional device has its own initial function. For example, the substrate 410 can provide a mounting position for the detector 500, the lead frame 420 can provide an electrical connection function for the detector 500, the radiation shield 430 is used to provide a corresponding light distribution function for the detector 500, etc. In the present application, by having the functional devices serve as the bearing portion of the getter structure, the functional devices, while providing their original functions, can also form a getter structure to provide the function of absorbing gas.

[0019] It is possible to have all the plurality of functional devices serve as the bearing portion of the getter structure. However, in the case where some functional devices have specific functions such as electrical connection, to prevent them from being used as a getter structure which might adversely affect their original functions, these functional devices may not be used as the bearing portion of the getter structure. Simply put, in the present application, not all functional devices must necessarily serve as the bearing portion of the getter structure.

[0020] In the case where at least one of the packaging device and the functional devices is used as the bearing portion, to form the getter structure, it is also necessary to provide a getter layer on the part of the surface of the bearing portion that is in communication with the sealed cavity, so as to use the getter layer to absorb gas in the sealed cavity. That is, the getter structure includes the bearing portion and the getter layer on the part of the surface of the bearing portion that is in communication with the sealed cavity. The getter layer 300 includes a material that absorbs gas. After being activated, the getter layer can absorb gas, thereby maintaining a vacuum environment in the space of the sealed cavity. More specifically, the getter layer 300 may include materials such as zirconium oxide, zirconium vanadium iron, and titanium zirconium vanadium. It should be noted that the getter layer 300 can be provided on any part of the inner surface of the housing 110, base 120, and cover 210 that is used to form the sealed cavity. However, to ensure that the light entry component 220 has good light transmission capability, the getter layer 300 is not provided on the surface of the light entry component 220.

[0021] In some embodiments, the getter layer 300 can

be provided only on the part of the inner surface of the packaging device used to form the sealed cavity. As mentioned above, the packaging device has a sealed cavity, i.e., the sealed cavity is surrounded by the multiple parts or multiple components included in the packaging device. Correspondingly, the inner surface of the packaging device necessarily includes a part for forming the sealed cavity. Therefore, the getter layer 300 can be provided on the part of the inner surface of the packaging device used to form the sealed cavity.

[0022] Alternatively, the getter layer 300 can be provided only on the part of the surface of the functional device that is in communication with the sealed cavity. As mentioned above, the functional device is mounted in the sealed cavity. Based on this, the surface of the functional device also necessarily includes a part directly exposed to the sealed cavity. This part is the part of the surface of the functional device that is in communication with the sealed cavity. Furthermore, the getter layer 300 can be provided on this part.

[0023] As above, the bearing portion is provided with the getter layer 300. The getter layer 300 can absorb gas. Thus, even as the usage time of the Dewar assembly increases and air or other gases enter the sealed cavity of the Dewar assembly, the getter layer 300 on the bearing portion can be used to absorb the gas, allowing the sealed cavity of the Dewar assembly to maintain a vacuum environment more sustainably. Of course, the getter layer 300 can also be provided on both the packaging device and the functional devices, thereby further increasing an area where the getter layer is provided in the Dewar assembly to enhance the gettering efficiency and gettering capacity of the Dewar assembly.

[0024] An embodiment of the present application discloses a Dewar assembly, including a packaging device and a plurality of functional devices in a sealed cavity of the packaging device. By using one or several of the packaging device and/or the plurality of functional devices as a bearing portion of the getter structure in the Dewar assembly, and providing a getter layer 300 on a part of a surface of the bearing portion that is in communication with the sealed cavity, even if gas leaks into the Dewar assembly, the getter layer 300 can be used to absorb the gas in the sealed cavity, thereby making the sustainability of the vacuum environment of the Dewar assembly relatively good. Furthermore, as mentioned above, in the technical solution disclosed in the embodiment of the present application, the packaging device and respective functional devices are all non-getter-dedicated components. By using the packaging device and the functional devices, which are originally basic components constituting the Dewar assembly, as the bearing portion for carrying the getter layer in the getter structure, there is no need to additionally arrange components in the Dewar assembly for providing a bearing function for the getter layer. Consequently, the overall size of the Dewar assembly is relatively small, i.e., the size of the packaging device is small. Thus, on the one hand, the

leak rate of the packaging device can be reduced; on the other hand, the volume of the sealed cavity can be made relatively small, reducing the difficulty of forming a vacuum environment in the Dewar assembly, thereby achieving the purpose of improving the vacuum reliability of the Dewar assembly.

[0025] As mentioned above, the getter layer 300 needs to be activated during use. Based on comprehensive considerations of cost, effect, etc., heating is generally used to activate the getter layer 300. Based on this, before the Dewar assembly is used, regarding the activation process of the getter layer 300 in the Dewar assembly, the getter layer 300 can be directly activated by heating. Afterwards, the component provided with the activated getter layer 300 is assembled integrally, or the component provided with the activated getter layer 300 is assembled into the packaging device.

[0026] However, as the usage time of the Dewar assembly increases, gas gradually intrudes into the sealed cavity, and the amount of gas absorbed by the getter layer 300 also gradually increases. This may lead to the risk of the getter layer having low gettering efficiency or even failing. In this case, to improve the service life of the Dewar assembly, it is usually necessary to reactivate the getter layer 300 in the Dewar assembly. During the reactivation process, to reduce workload and prevent damage to the Dewar assembly during disassembly and assembly, methods such as placing a heat source outside the Dewar assembly are generally used to activate the getter layer 300 arranged inside the Dewar assembly. Based on this, the getter layer 300 can be provided on the inner surface of the packaging device in the Dewar assembly, and/or on a surface of one or several of the functional devices that are relatively adjacent to the packaging device, to reduce the difficulty of activating the getter layer 300.

[0027] As mentioned above, the packaging device may include a base 120 and a housing 110, the housing 110 being connected to the base 120. In some embodiments, the functional devices may include a cold finger 440. Accordingly, the cold finger 440 is in the sealed cavity and is mounted on the base 120. In some embodiments, the cold finger 440 is connected to a central region of the substrate 410 of the Dewar assembly, and a portion where the cold finger 440 connects to the substrate 410 is the cold head 450. In the embodiment of the present application, at least a part of the housing 110 is surrounded an outside of the cold finger 440, and the inner surface of the housing 110 facing the cold finger 440 is provided with the getter layer 300. In this case, the getter layer 300 provided on the inner surface of the housing 110 can be activated by direct heating, and the activation efficiency and activation effect of this method are relatively good. It should be noted that a thickness of the getter layer 300 is relatively small. Therefore, in a macroscopic sense, the getter layer 300 and the housing 110 can be considered as an integrated structure. For ease of description, the housing 110 formed with the

getter layer 300 will still be referred to as the "housing" hereinafter.

[0028] Furthermore, during the design of the housing 110, since there is no need to mount other relatively large components between the housing 110 and the cold finger 440, such as additionally provided columnar or tubular getter structures for providing gettering action, in the present application, a portion of the housing 110 surrounding the outside of the cold finger 440 can be shaped to conform to the cold finger 440. That is, the shape of the housing 110 is similar to that of the cold finger 440. This can maximize the reduction of the spacing between the housing 110 and the cold finger 440, thereby making the volume of the space sandwiched between the housing 110 and the cold finger 440 relatively smaller.

[0029] By arranging the housing 110 and the cold finger 440 closely adjacent, "closely adjacent" means that the housing 110 and the cold finger 440 are spaced apart from each other without contact, and the gap between them is relatively small. This can further reduce a gap between the housing 110 and the cold finger 440, making the volume of the entire sealed cavity smaller, thereby reducing the difficulty of forming a vacuum environment in the Dewar assembly and reducing the leak rate of the packaging device. Of course, to ensure that the cold finger 440 can be normally mounted into the housing 110, the housing 110 still needs to reserve a mounting gap for the cold finger 440. That is, when the cold finger 440 is mounted into the housing 110, there is still a relatively small gap between opposing parts of the cold finger and the housing. The specific size of the gap can be flexibly determined according to the actual situation, but the size of this gap is much smaller than the spacing size between the housing and the cold finger in the technical solution where an additional getter structure needs to be provided.

[0030] In other words, in the embodiment of the present application, the portion of the housing 110 surrounding the outside of the cold finger 440 is shaped to conform to and closely adjacent to the cold finger 440. For example, in a direction perpendicular to an axial direction of the cold finger 440, a gap between a part of the cold finger 440 directly opposing the housing 110 and the housing 110 is less than 3 mm. Moreover, where mounting accuracy permits, the gap between the cold finger 440 and the housing 110 in the above-mentioned direction can be less than 2 mm. This makes it impossible to additionally arrange other components between the cold finger and the housing, and ensures that the gap between the cold finger and the housing is relatively small. Consequently, the volume of the space enclosed between the cold finger and the housing is relatively small, which can greatly reduce the overall volume of the accommodating cavity inside the Dewar assembly, thereby reducing the difficulty of forming a vacuum environment in the Dewar assembly and decreasing the leak rate of the Dewar assembly.

[0031] It should be noted that, generally, the cold finger

440 is a cylindrical structure. In this case, the above-mentioned direction perpendicular to the axial direction of the cold finger 440 is a radial direction of the cold finger 440. Additionally, a thickness of the getter layer 300 formed on the bearing portion is generally small, usually less than 1 mm, and the thickness of the getter layer 300 can even be made below 2 μm . This can basically ensure that the getter layer has a satisfactory gettering capacity. Thus, there is still an assembly gap of more than 1 mm between the getter layer 300 and the cold finger 440, ensuring that the cold finger 440 can be normally mounted into the housing 110 and that the cold finger 440 and the getter layer 300 are spaced apart from each other.

[0032] To increase the area of the getter layer 300 provided in the Dewar assembly, in some embodiments, the inner surface of the cover 210 of the packaging device is provided with the getter layer 300. In this case, the getter layer 300 on the inner surface of the cover 210 can also be activated by direct heating outside the Dewar assembly.

[0033] As mentioned above, the getter layer 300 can also be provided on the surface of the functional device. Similar to the housing 110, the functional device formed with the getter layer 300 will still be referred to as the "functional device" hereinafter. In some embodiments, the functional device includes a radiation shield 430. The radiation shield 430 is at inner side of the cover 210, and the outer surface of the radiation shield 430 can be provided with the getter layer 300. The outer surface of the radiation shield 430 may include, for example, the surface of the radiation shield 430 facing the cover 210. In this case, after the Dewar assembly has been used for a period of time, utilizing the effect that heat can propagate through radiation, the getter layer 300 on the outer surface of the radiation shield 430 can also be activated by directly heating outside the Dewar assembly, and the getter layer 300 provides the function of absorbing gas.

[0034] Additionally, when designing the cover 210 in the Dewar assembly, the cover 210 can also be shaped to conform to the radiation shield 430, thereby making the gap between them relatively smaller and further reducing the volume of the space between them. At the same time, by appropriately designing the sizes of the cover and the radiation shield, the cover and the radiation shield can be arranged closely adjacent to further reduce the volume of the space between the cover 210 and the radiation shield 430, thereby further reducing the volume of the accommodating cavity, achieving the purpose of reducing the difficulty of forming a vacuum environment in the sealed cavity and reducing the leak rate of the packaging device.

[0035] Similarly, the cover 210 being shaped to conform to and closely adjacent to the radiation shield 430 can also refer to the corresponding design for the housing 110 and the cold finger 440 in the above embodiment. The structure of the cover 210 can be adaptively designed based on the outer shape of the radiation shield 430. Thus, after the radiation shield 430 is mounted at

inner side of the cover 210, in a direction perpendicular to an optical axis direction of the light entry component, there is a relatively small gap between any position on the radiation shield 430 and a corresponding position on the cover 210. The size of this gap can be, for example, less than 3 mm. Where mounting precision permits, this gap can be further reduced to less than 2 mm. This makes the space sandwiched between the cover 210 and the radiation shield 430 relatively small, and prevents further arrangement of other additional components, thereby further reducing the volume of the entire accommodating cavity. It should be noted that the above-mentioned direction perpendicular to the optical axis direction of the light entry component is the radial direction of the cold finger.

[0036] In a case where an outer surface of the radiation shield 430 is provided with the getter layer 300, an inner surface of the radiation shield 430 can also be further provided with the getter layer 300. Thus, during the process of heating the radiation shield 430 by radiation, the getter layers 300 on the inner surface and the outer surface of the radiation shield 430 can be activated together, greatly enhancing the gas absorption capacity inside the Dewar assembly without significantly increasing the complexity and time consumption of the activation process of the getter layer 300.

[0037] As mentioned above, in the Dewar assembly disclosed in the embodiment of the present application, at least one of the packaging device and the functional devices can serve as the bearing portion of the getter structure, and surfaces of the bearing portion that are in communication with the sealed cavity are all covered with a getter layer, such that the getter layers 300 on the surfaces of the bearing portions can form a continuous dense film layer, which can be, for example, an isolating film body. In this case, compared to the bearing portion, the isolating film body is closer to an internal space of the packaging device, that is, the isolating film body can surround the sealed cavity and isolate the bearing portion from the sealed cavity, thereby preventing gas that may be released from the bearing portion from entering the sealed cavity through the surface of the bearing portion that is in communication with the sealed cavity.

[0038] That is, when the above technical solution is adopted, the getter layer 300 can also be used to cover the surface of the bearing portion. Thus, even if there are microporous structures inside the bearing portion, the isolating film body can inhibit or even prevent gas within the microporous structures from escaping from the surface of the bearing portion facing the sealed cavity to the outside of the bearing portion, thereby destroying the vacuum environment inside the sealed cavity. Furthermore, as mentioned above, in the case of the present application where the packaging device and the functional devices are used as the bearing portion of the getter structure, the overall size of the packaging device is relatively small. This can also significantly reduce an area of a part of the packaging device that is in communication with the sealed cavity, thereby reducing an out-

gassing source area of the packaging device. Thus, even if the inhibitory effect of the getter layer 300 on the gas release effect from the surface of the bearing portion diminishes over time, the amount of gas escaping from the packaging device into the sealed cavity can be significantly reduced by reducing the outgassing source area, achieving the purpose of improving the maintenance duration of the vacuum environment of the Dewar assembly.

[0039] As mentioned above, due to current technical development bottlenecks, even if materials with high strength and relatively hard texture, such as metals, are used to form the bearing portion, microporous structures may still exist inside the material. After a vacuum environment is formed in the sealed cavity, gas inside the material of the bearing portion may escape from the surface of the material and enter the sealed cavity, destroying the vacuum environment of the sealed cavity. Therefore, in a case where at least part of the bearing portion is made of a material that can release gas from its surface, the getter layer 300 can cover at least part of the surfaces of the bearing portion that are in communication with the sealed cavity.

[0040] Based on the above technical solution, to balance machining difficulty, the getter layer 300 can generally cover the surfaces of the bearing portion that are in communication with the sealed cavity. However, limited by factors such as the precision of the machining technology, in practical applications, the getter layer 300 may not form a complete and dense film layer. In other words, there may be fine pores in the getter layer 300 covering the surfaces of the bearing portion that are in communication with the sealed cavity. Although gas released from the material in the bearing portion can still enter the sealed cavity through these fine pores, adopting this technical solution can greatly reduce the difficulty of forming the getter layer 300 and significantly lower the machining cost of the getter layer 300, thereby improving the comprehensive performance of the Dewar assembly.

[0041] As for the gas released by the material that can release gas from its surface and entering the sealed cavity through the aforementioned fine pores, the getter layer 300 covering the surface of the bearing portion can be used to absorb the gas. At the same time, since the amount of gas released by the bearing portion is relatively small, and the amount of gas that can enter the sealed cavity through the fine pores existing on the getter layer 300 is even smaller, even if the presence of fine pores on the getter layer 300 causes the bearing portion to release gas into the sealed cavity, it will basically not adversely affect the stability of the vacuum environment of the sealed cavity. However, adopting this technical solution can significantly reduce the difficulty of forming the getter layer 300 and the machining cost.

[0042] Based on the Dewar assembly disclosed in any of the above embodiments, an embodiment of the present application further discloses a machining method for machining any of the above Dewar assemblies. As

shown in FIG. 5, the machining method includes steps S1 to S3.

[0043] At step S1, an oxide layer on a surface of a bearing portion is removed to form a first intermediate. In some embodiments, an acidic solution can be used to react with the oxide layer to remove the oxide layer on the surface of the bearing portion. The efficiency and effect of this removal method are relatively good. In some embodiments, the specific composition of the acidic solution can be determined according to actual needs and is not limited herein. Additionally, during this process, ultrasonic waves can also be used to assist the removal process, thereby separating the substances formed by the reaction between the acidic solution and the oxide layer from the surface of the bearing portion, ensuring that the oxide layer on the surface of the bearing portion is completely removed. The reaction time between the bearing portion and the acidic solution can also be determined according to the actual situation. The bearing portion includes at least one of a packaging device and a functional device.

[0044] At step S2, a passivation layer is formed on a surface of the first intermediate. In some embodiments, by immersing the first intermediate in a passivation solution for a preset period, the passivation layer can be formed on the surface of the first intermediate, thereby forming a second intermediate. In some embodiments, the specific composition of the passivation solution can also be flexibly selected according to a material of the bearing portion and other specific conditions, and is not limited herein.

[0045] At step S3, a getter layer is formed on at least part of a surface of the second intermediate. In some embodiments, based on a type of the getter layer 300, a method for forming the getter layer 300 on the surface of the second intermediate can be selected. To improve the film-forming efficiency and film-forming stability of the getter layer 300, in an embodiment of the present application, magnetron sputtering can be used to form the getter layer 300 on the surface of the second intermediate, thereby forming a getter structure. Additionally, in the step S3, the getter layer can be formed only on a part of a surface of the second intermediate that is in communication with the formed sealed cavity. Considering machining difficulty, the getter layer can be formed on both the surface of the second intermediate where the sealed cavity is formed and the surfaces of the second intermediate that are located inside the sealed cavity.

[0046] To further improve an adhesion reliability of the getter layer on the surface of the bearing portion, before the step S1, the machining method for the Dewar assembly disclosed in the embodiment of the present application may further include a step of removing process debris and other impurities. In some embodiments, the workpiece to be coated can be immersed in an alkaline solution, supplemented by an ultrasonic cleaning process, to remove process debris from the surface of the bearing portion and improve a surface cleanliness of the bearing portion. Furthermore, between the step S1 and

step S2, a deionized water cleaning step can be added to prevent residual acidic solution on the surface of the first intermediate from adversely affecting the passivation process. The machining process of the Dewar assembly includes not only the above steps but also the manufacturing and forming process of components such as the bearing portion, as well as the assembly process between components. For the sake of brevity, detailed description is omitted here.

[0047] As mentioned above, the bearing portion in the Dewar assembly is provided with the getter layer 300. However, for some components such as the substrate 410, due to other reasons such as the need to lay circuits, conditions for providing the getter layer 300 may not be available. As mentioned above, even if this component may be formed using materials such as metal and its post-forming state is a solid structure, due to the influence of the material itself, there may be microporous structures containing gas inside the component. Furthermore, to further reduce the probability of the vacuum environment inside the Dewar assembly being damaged by its own components, the machining method disclosed in the embodiment of the present application further includes: before assembling the Dewar assembly, removing gas from non-getter structures, the non-getter structures including the above-mentioned substrate 410. In some embodiments, the gas in the non-getter structure can be removed by baking. To prevent the baking process from damaging the workpiece, the baking temperature can be controlled at 80-100°C. By appropriately increasing the baking time, it can also be ensured that the gas inside the non-getter structure escapes from the interior of the workpiece.

[0048] After the Dewar assembly is assembled, a vacuum pump can be further used to evacuate the sealed cavity of the Dewar assembly, and a helium mass spectrometer can be used to perform a leak rate test on the Dewar assembly. After the leak rate meets the requirements, the getter layer 300 can be activated by heating or other methods, enabling the getter layer 300 to start functioning and maintain the vacuum environment in the sealed cavity of the Dewar assembly. After the gas in the non-getter structures is removed, the assembly work of the Dewar assembly can also be completed in a vacuum environment to prevent gas from re-entering components such as the non-getter structures. Furthermore, the getter layer 300 can be activated in advance before the assembly process of the Dewar assembly is performed.

[0049] Based on the Dewar assembly disclosed in any of the above embodiments, the present application further discloses a detection device, including a detector 500 and any of the above Dewar assemblies. The detector 500 can be, for example, an infrared detector. The detector 500 is in the sealed cavity of the Dewar assembly, and the detector 500 can be mounted on the substrate 410 of the Dewar assembly. The substrate 410 of the Dewar assembly is mounted on the cold finger 440 of

the Dewar assembly, and the cold finger 440 can provide a low-temperature environment for the detector 500.

[0050] It should be noted that, in this document, the terms "include," "comprise," or any other variation thereof are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that includes a list of elements includes not only those elements but also other elements not expressly listed, or also includes elements inherent to such process, method, article, or apparatus. Without further limitation, an element defined by the phrase "including one ..." does not exclude the presence of additional identical elements in the process, method, article, or apparatus that includes the element. In addition, it should be pointed out that the scope of the methods and apparatuses in the embodiments of the present application is not limited to performing functions in the order shown or discussed, but may also include performing functions in a substantially simultaneous manner or in a reverse order according to the functions involved. For example, the described methods may be performed in an order different from that described, and various steps may be added, omitted, or combined. Additionally, features described with reference to certain examples may be combined in other examples.

[0051] The embodiments of the present application have been described above with reference to the accompanying drawings, but the present application is not limited to the above specific implementations. The above specific implementations are merely illustrative and not restrictive. Under the guidance of the present application, a person of ordinary skill in the art could make many modifications without departing from the purpose of the present application and the scope of protection of the claims, all of which fall within the protection scope of the present application.

Claims

1. A Dewar assembly, comprising a packaging device and a plurality of functional devices; wherein

the packaging device has a sealed cavity, the plurality of functional devices are all mounted in the sealed cavity, the packaging device and the plurality of functional devices are all non-getter-dedicated components, at least one of the plurality of functional devices serves as a bearing portion of a getter structure, and/or the packaging device serves as the bearing portion of the getter structure; and the getter structure comprises a getter layer (300) on at least part of a surface of the bearing portion that is in communication with the sealed cavity, and the getter structure is configured to utilize the getter layer (300) to absorb gas in the sealed cavity.

2. The Dewar assembly according to claim 1, wherein the packaging device comprises a base (120) and a housing (110) connected to each other,

wherein the plurality of functional devices comprise a cold finger (440) mounted on the base (120),

wherein at least a part of the housing (110) is surrounded an outside of the cold finger (440), and an inner surface of the housing (110) facing the cold finger (440) is provided with the getter layer (300); and

wherein a portion of the housing (110) surrounding the outside of the cold finger (440) is shaped to conform to and closely adjacent to the cold finger (440).

3. The Dewar assembly according to claim 1, wherein the packaging device comprises a housing (110), a cover (210), and a light entry component (220),

wherein an end of the cover (210) is connected to the housing (110), and the light entry component (220) is at another end of the cover (210), and

wherein an inner surface of the cover (210) is provided with the getter layer (300).

4. The Dewar assembly according to claim 1, wherein the packaging device comprises a cover (210) and a light entry component (220) connected to each other,

wherein the plurality of functional devices comprise a radiation shield (430), wherein the radiation shield (430) is at an inner side of the cover (210), and an outer surface of the radiation shield (430) is provided with the getter layer (300);

wherein the cover (210) is shaped to conform to and closely adjacent to the radiation shield (430); and

wherein an inner surface of the radiation shield (430) is provided with the getter layer (300).

5. The Dewar assembly according to any one of claims 1 to 4, wherein surfaces of the bearing portion that are in communication with the sealed cavity are covered with the getter layer (300), and wherein the getter layer (300) forms an isolating film body, the isolating film body surrounds the sealed cavity and isolates the bearing portion from the sealed cavity.

6. The Dewar assembly according to any one of claims 1 to 5, wherein at least part of the bearing portion is made of a material capable of releasing gas from its surface, and the getter layer (300) covers a surface of the material that is in communication with the

sealed cavity, to prevent the gas released by the material from entering the sealed cavity.

7. A machining method for a Dewar assembly, comprising:

removing an oxide layer on a surface of a bearing portion to form a first intermediate, wherein the bearing portion comprises at least one of a packaging device and a functional device; forming a passivation layer on a surface of the first intermediate to form a second intermediate; and forming a getter layer (300) on at least part of a surface of the second intermediate to form a getter structure.

8. The machining method according to claim 7, wherein forming the getter layer (300) on the surface of the second intermediate to form the getter structure comprises:

forming the getter layer (300) on the surface of the second intermediate by magnetron sputtering to form the getter structure.

9. The machining method according to claim 8, wherein the Dewar assembly comprises a substrate (410), the substrate (410) is configured to mount a detector (500), and the method further comprises: before assembling the Dewar assembly, removing gas from a non-getter structure, the non-getter structure comprising the substrate (410).

10. A detection device, comprising a detector (500) and the Dewar assembly according to any one of claims 1-6, wherein the Dewar assembly comprises a substrate (410), the substrate (410) and the detector (500) are both in the sealed cavity of the Dewar assembly, and the detector (500) is mounted on the substrate (410).

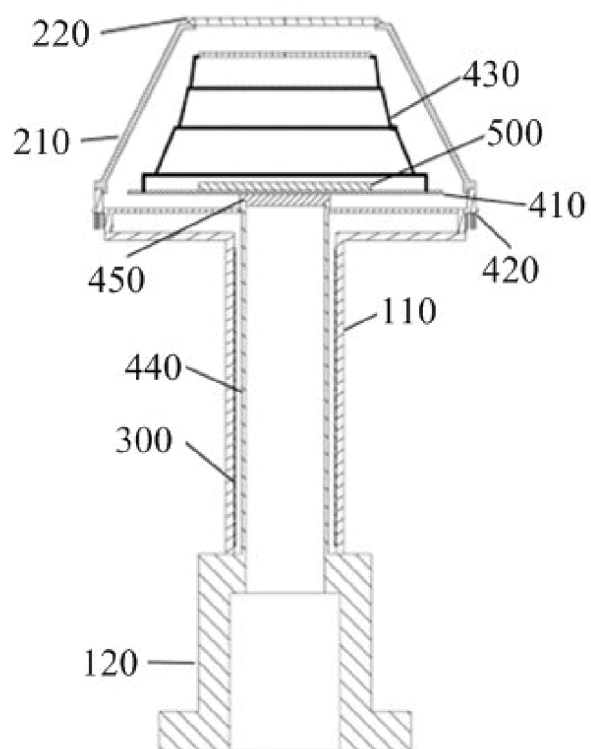


FIG. 1

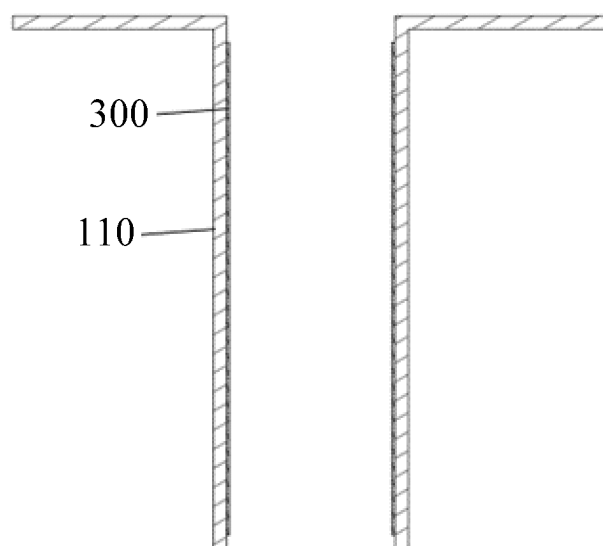


FIG. 2

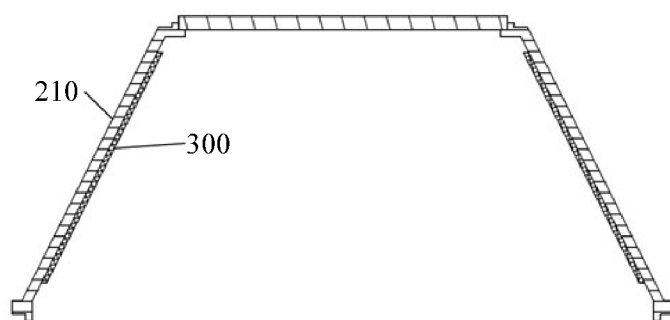


FIG. 3

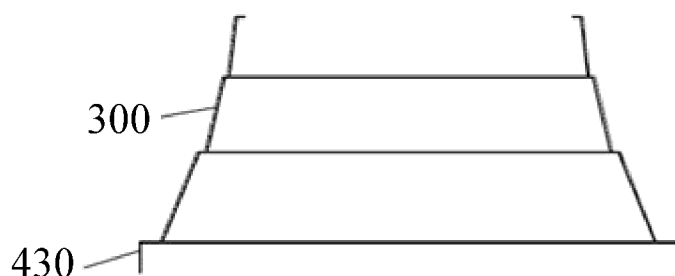


FIG. 4

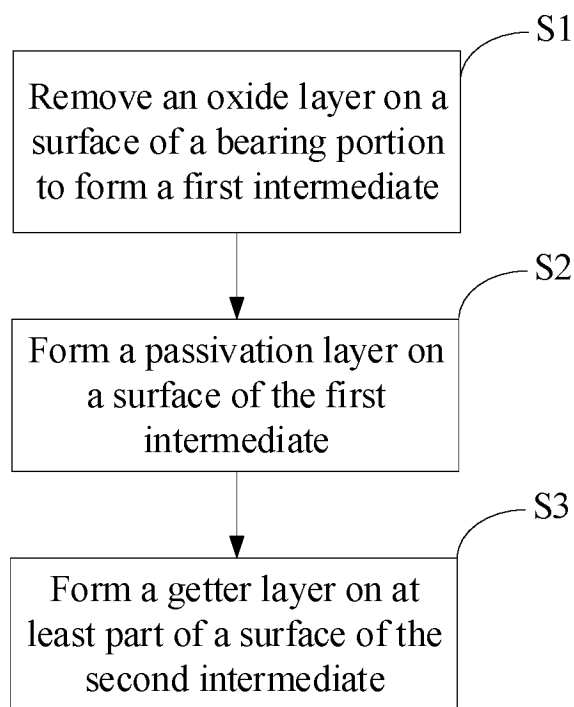


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/117944

A. CLASSIFICATION OF SUBJECT MATTER

B65D81/20(2006.01)i; B65D25/20(2006.01)i; B65D25/02(2006.01)i; G01J5/02(2022.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC:B65D.G01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNTXT, WPABS, ENTXT, DWPI: 杜瓦, 吸气, 层, 磁控溅射; dewar, air suction, layer, magnetron sputtering;

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 117262490 A (HANGZHOU HIKMICRO SENSING TECHNOLOGY CO., LTD.) 22 December 2023 (2023-12-22) description, specific embodiments, and figures	1-10
PX	CN 220871906 U (HANGZHOU HIKMICRO SENSING TECHNOLOGY CO., LTD.) 30 April 2024 (2024-04-30) description, specific embodiments, and figures	1-10
X	CN 210625860 U (ZHEJIANG QUANTUM INFRARED TECHNOLOGIES LTD.) 26 May 2020 (2020-05-26) description, specific embodiments, and figures	1-6, 10
X	WO 2022244788 A1 (INTER-UNIVERSITY RESEARCH INSTITUTE CORPORATION HIGH ENERGY ACCELERATOR RESEARCH ORGANIZATION et al.) 24 November 2022 (2022-11-24) description, pages 5-22, and figures 1-6	7-9
A	CN 110440931 A (WUHAN GLOBAL SENSOR TECHNOLOGY CO., LTD.) 12 November 2019 (2019-11-12) entire document	1-10

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"D" document cited by the applicant in the international application	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"E" earlier application or patent but published on or after the international filing date	"&" document member of the same patent family
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

02 January 2025

Date of mailing of the international search report

06 January 2025

Name and mailing address of the ISA/CN

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Beijing 100088

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/CN2024/117944

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	117262490	A	22 December 2023	None			
CN	220871906	U	30 April 2024	None			
CN	210625860	U	26 May 2020	None			
WO	2022244788	A1	24 November 2022	EP	4343018	A1	27 March 2024
				KR	20240011127	A	25 January 2024
				JP	2022178656	A	02 December 2022
				CN	117203365	A	08 December 2023
CN	110440931	A	12 November 2019	None			