

DESCRIPTION

Title of the Invention: ISOPROPYL ALCOHOL ACCOMMODATING BODY,
MANUFACTURING METHOD FOR SAID ACCOMMODATING BODY, AND QUALITY
CONTROL METHOD FOR ISOPROPYL ALCOHOL ACCOMMODATING BODY

TECHNICAL FIELD

[0001]

The present disclosure relates to an isopropyl alcohol accommodating body containing isopropyl alcohol accommodated in a container, a method for manufacturing an accommodating body, and a quality control method for an isopropyl alcohol accommodating body.

BACKGROUND ART

[0002]

The isopropyl alcohol (also referred to as 2-propanol) is an organic solvent to be used in various applications, and in particular, is used as a cleaning liquid or a drying liquid in a step of manufacturing a semiconductor device. In recent years, as demand for higher performance in semiconductor devices increases, elements and wiring have become finer and more highly integrated, and there is a growing demand for isopropyl alcohol to be used as a cleaning liquid or a drying liquid to be highly purified with extremely low levels of metal impurities.

[0003]

For example, Patent Document 1 discloses that, when isopropyl alcohol in which impurities are increased due to long-term storage is used for cleaning in a step of manufacturing a semiconductor device, residues derived from the impurities in the isopropyl alcohol may remain on a surface of the semiconductor device after cleaning and drying, which may cause defects in the semiconductor device. As can be seen from this, the influence of the quality of the isopropyl alcohol to be used as a cleaning liquid or a drying liquid on a yield of semiconductor devices cannot be ignored, and there is a strong demand for improving the quality of the isopropyl alcohol.

[0004]

In addition, organic impurities such as acetone are present as impurities in the isopropyl alcohol, and it is known that when a concentration of dissolved oxygen in the isopropyl alcohol is high, a content of the organic impurities in the isopropyl alcohol increases (for example, see Patent Document 2 or 3). As a method for reducing a concentration of dissolved oxygen in isopropyl alcohol, Patent Document 2 proposes a method for controlling an oxygen partial pressure in a gaseous phase portion of a distillation column in a distillation step during the production of isopropyl alcohol. In addition, Patent Document 3 proposes a method for removing dissolved oxygen by blowing and bubbling an inert gas such as nitrogen into isopropyl alcohol.

Citation List

Patent Document

[0005]

Patent Document 1: PCT International Publication No.
WO2020/071307

Patent Document 2: PCT International Publication No.
WO2018/135408

Patent Document 3: Japanese Unexamined Patent
Application, Publication No. 2014-201524

Patent Document 4: PCT International Publication No.
WO2020/009225

DISCLOSURE OF THE INVENTION

Problems to be Solved by the Invention

[0006]

According to the method described in Patent Document 2 or 3, high-purity isopropyl alcohol with reduced concentration of dissolved oxygen can be produced. The produced isopropyl alcohol is stored in a storage tank, is charged into a container such as an ISO (International Organization for Standardization) tank container or a canister can when shipped as a product, and is shipped and delivered. Patent Document 4 describes sealing high-purity nitrogen gas in a container.

[0007]

Isopropyl alcohol charged into a container such as an ISO tank container or a canister can may have an interval of several tens of days to several months until the isopropyl

alcohol is used as a cleaning liquid or a drying liquid in a step of manufacturing a semiconductor device. As a result of studies by the present inventors, it has been found that, even when a container is filled with isopropyl alcohol having a low concentration of dissolved oxygen and produced by using the above methods, and sealed with the nitrogen gas having a low oxygen concentration, if the isopropyl alcohol in the container is analyzed after an interval of several tens of days to several months, a content of metal impurities or a content of organic impurities such as acetone increases, and the isopropyl alcohol may not be used for cleaning a semiconductor.

[0008]

Therefore, an object of the present disclosure is to provide an isopropyl alcohol accommodating body in which an increase in a content of metal impurities or a content of organic impurities such as acetone is prevented after long-term storage, and a manufacturing method for the same.

Means for Solving the Problems

[0009]

The present inventors have intensively studied to solve the above problems. First, when the container having a high content of metal impurities or organic impurities such as acetone was confirmed, it was found that even if the container was filled with the isopropyl alcohol supplied from the same storage tank and sealed with the same nitrogen gas, the

content of metal impurities or the content of organic impurities such as acetone may be high. Although the concentration of dissolved oxygen in a lot of isopropyl alcohol used at that time and the oxygen concentration in the nitrogen gas used for sealing were also confirmed, but neither oxygen concentration was found to be problematic. In addition, it was also confirmed that even when the same container was filled with isopropyl alcohol having the same concentration of dissolved oxygen, sealed with nitrogen gas having the same oxygen concentration, and stored for a long period of time, an increase in a content of metal impurities or a content of organic impurities such as acetone in the isopropyl alcohol may be prevented. Accordingly, it was confirmed that there was no damage or the like to the used container. On the other hand, it was found that when a container having a high content of metal impurities or a high content of organic impurities such as acetone is confirmed, an oxygen concentration in a gaseous phase portion and a content of chromium in the isopropyl alcohol in the container are high.

[0010]

From these findings, it is presumed that the reason why the content of organic impurities such as acetone and the content of chromium increase during long-term storage was that the oxygen concentration immediately after charging became high for several reasons, and the content of organic impurities such as acetone and the content of chromium increase during long-term storage of oxygen in the container.

It has been found that by setting an oxygen concentration in a gas in the container after being filled with the isopropyl alcohol and sealed with an inert gas such as nitrogen to a predetermined concentration or less, an increase over time in the content of the organic impurities such as acetone during long-term storage can be prevented, and the present invention has been completed.

[0011]

Specific means for solving the above problems include the following embodiments.

<1> An isopropyl alcohol accommodating body containing: isopropyl alcohol accommodated in a container, an oxygen content in the container being 0.001 ppm by mol to 0.100 ppm by mol with respect to the isopropyl alcohol, a content of acetone as an impurity in the isopropyl alcohol being 10 ppb to 200 ppb on a mass basis.

[0012]

<2> The isopropyl alcohol accommodating body as described in <1>, in which a content of chromium as an impurity in the isopropyl alcohol is 0.01 ppt to 2.50 ppt on a mass basis.

[0013]

<3> The isopropyl alcohol accommodating body as described in <1> or <2>, in which a volume of the container is in a range of 1,000 L to 1,500,000 L.

[0014]

<4> The isopropyl alcohol accommodating body as described in <3>, in which the container is an intermediate bulk

container, a tank lorry, an ISO tank container, or a storage tank.

[0015]

<5> A method for manufacturing an isopropyl alcohol accommodating body in which isopropyl alcohol is accommodated in a container, the method including:
setting an oxygen concentration in a gas in the container to 0.1 ppm to 10 ppm on a volume basis when the isopropyl alcohol is accommodated in the container.

[0016]

<6> The method for manufacturing an isopropyl alcohol accommodating body as described in <5>, in which a concentration of dissolved oxygen in the isopropyl alcohol to be accommodated in the container is 0.001% to 0.050% with respect to an oxygen saturation solubility at 25°C in the atmosphere.

[0017]

<7> The method for manufacturing an isopropyl alcohol accommodating body as described in <5> or <6>, in which a content of acetone as an impurity in the isopropyl alcohol to be accommodated in the container is 10 ppb to 200 ppb on a mass basis.

[0018]

<8> The method for manufacturing an isopropyl alcohol accommodating body as described in any one of <5> to <7>, in which a content of chromium as an impurity in the isopropyl alcohol to be accommodated in the container is 0.01 ppt to

2.50 ppt on a mass basis.

[0019]

<9> The method for manufacturing an isopropyl alcohol accommodating body as described in any one of <5> to <8>, in which a volume of the container is in a range of 1,000 L to 1,500,000 L.

[0020]

<10> The method for manufacturing an isopropyl alcohol accommodating body as described in <9>, in which the container is an intermediate bulk container, a tank lorry, an ISO tank container, or a storage tank.

[0021]

<11> A method for manufacturing an isopropyl alcohol accommodating body in which isopropyl alcohol is accommodated in a container, the method including:
accommodating the isopropyl alcohol in an amount of 2% to 98% of a volume of the container; and
setting an oxygen concentration in a gas in the container to 0.1 ppm to 10 ppm on a volume basis when the isopropyl alcohol is accommodated in the container.

[0022]

<12> The method for manufacturing an isopropyl alcohol accommodating body as described in <11>, further including: in which a concentration of dissolved oxygen in the isopropyl alcohol to be accommodated in the container is 0.001% to 0.050% with respect to an oxygen saturation solubility at 25°C in the atmosphere.

[0023]

<13> The method for manufacturing an isopropyl alcohol accommodating body as described in <11> or <12>, in which a content of acetone as an impurity in the isopropyl alcohol to be accommodated in the container is 10 ppb to 200 ppb on a mass basis.

[0024]

<14> The method for manufacturing an isopropyl alcohol accommodating body as described in any one of <11> to <13>, in which a content of chromium as an impurity in the isopropyl alcohol to be accommodated in the container is 0.01 ppt to 2.50 ppt on a mass basis.

[0025]

<15> The method for manufacturing an isopropyl alcohol accommodating body as described in any one of <11> to <14>, in which a volume of the container is in a range of 1,000 L to 1,500,000 L.

[0026]

<16> The method for manufacturing an isopropyl alcohol accommodating body as described in <15>, in which the container is an intermediate bulk container, a tank lorry, an ISO tank container, or a storage tank.

[0027]

<17> A method for manufacturing an isopropyl alcohol accommodating body in which isopropyl alcohol accommodated in a first container is transferred to a second container, the method including:

setting an oxygen concentration in a gas in the second container to 0.1 ppm to 10 ppm on a volume basis when the isopropyl alcohol is accommodated in the second container.

[0028]

<18> The method for manufacturing an isopropyl alcohol accommodating body as described in <17>, in which a concentration of dissolved oxygen in the isopropyl alcohol to be accommodated in the second container is 0.001% to 0.050% with respect to an oxygen saturation solubility at 25°C in the atmosphere.

[0029]

<19> The method for manufacturing an isopropyl alcohol accommodating body as described in <17> or <18>, in which a content of acetone as an impurity in the isopropyl alcohol to be accommodated in the second container is 10 ppb to 200 ppb on a mass basis.

[0030]

<20> The method for manufacturing an isopropyl alcohol accommodating body as described in any one of <17> to <19>, in which a content of chromium as an impurity in the isopropyl alcohol to be accommodated in the second container is 0.01 ppt to 2.50 ppt on a mass basis.

[0031]

<21> The method for manufacturing an isopropyl alcohol accommodating body as described in any one of <17> to <20>, in which a volume of the container is in a range of 1,000 L to 1,500,000 L.

[0032]

<22> The method for manufacturing an isopropyl alcohol accommodating body as described in <21>, in which the container is an intermediate bulk container, a tank lorry, an ISO tank container, or a storage tank.

[0033]

<23> A quality control method for an isopropyl alcohol accommodating body in which isopropyl alcohol is accommodated in a container, the method including:
setting a concentration of dissolved oxygen in the isopropyl alcohol to 0.001% to 0.050% with respect to an oxygen saturation solubility at 25°C in the atmosphere; and setting an oxygen concentration in a gas in the container to 0.1 ppm to 10 ppm on a volume basis.

Effects of the Invention

[0034]

According to the present disclosure, it is possible to provide the isopropyl alcohol accommodating body capable of preventing an increase in a content of metal impurities such as chromium or a content of organic impurities such as acetone during long-term storage. In particular, the manufacturing method of the present disclosure can also be applied to a case in which isopropyl alcohol is accommodated in a container having a large internal volume such as an ISO tank container or a storage tank. The isopropyl alcohol accommodating body of the present disclosure can perform long-term storage for

several tens of days to several months, and the accommodated isopropyl alcohol can be suitably used as a cleaning liquid or a drying liquid for a semiconductor device, and thus the isopropyl alcohol accommodating body has a high industrial availability.

PREFERRED MODE FOR CARRYING OUT THE INVENTION

[0035]

In the present specification, unless otherwise specified, a notation "A to B" using numerical values A and B means "A or more and B or less". In such a notation, when a unit is added to only the numerical value B, the unit is also applied to the numerical value A.

[0036]

In the following description, unless otherwise specified, "%", "ppm", "ppb", and "ppt" representing concentrations are all on a mass basis, including examples. Furthermore, "vol%" and "ppm by vol" expressing concentrations indicate volume fractions, including the examples, and "ppm by mol" indicates molar fraction.

[0037]

<Isopropyl Alcohol Accommodating Body>

An isopropyl alcohol accommodating body of the present disclosure (hereinafter, also simply referred to as "accommodating body") is an accommodating body in which isopropyl alcohol is accommodated in a container, in which an

oxygen content in the container is 0.001 ppm by mol to 0.100 ppm by mol with respect to the isopropyl alcohol, and a content of acetone as an impurity in the isopropyl alcohol is 10 ppb to 200 ppb. The interior of the accommodating body includes a portion filled with isopropyl alcohol (hereinafter, this portion is also referred to as a "liquid phase portion") and a space portion not filled with isopropyl alcohol (hereinafter, this portion is also referred to as a "gaseous phase portion").

[0038]

With such an accommodating body, an increase in a content of metal impurities such as chromium and organic impurities such as acetone during long-term storage is prevented, thereby making long-term storage for several tens of days to several months become possible. Although the reason is not clear, the present inventors presume as follows.

[0039]

When oxygen is present in the isopropyl alcohol, the oxygen reacts with the isopropyl alcohol to by-produce acetone. Therefore, it was considered that the increase in the content of the organic impurities such as acetone in the isopropyl alcohol in the container is prevented by filling the container with isopropyl alcohol having a low concentration of dissolved oxygen and sealing the container with an inert gas such as nitrogen gas. However, when there is a very small gap or the like in a pipe for transferring a liquid from the storage tank to the container, a pipe for sealing the

container with nitrogen gas, and the like, an extremely small amount of oxygen may be mixed. In addition, the container such as an ISO tank container is often returned after the isopropyl alcohol in the container is consumed, filled with isopropyl alcohol, and reshipped. Generally, the container is sufficiently washed and then filled with isopropyl alcohol, and oxygen may remain in the container due to the washing at that time.

[0040]

In such a case, even if the container is filled with the isopropyl alcohol having a low concentration of dissolved oxygen and sealed with the inert gas such as nitrogen gas, a relatively large amount of oxygen is present in the accommodating body. A certain amount of oxygen is dissolved in the isopropyl alcohol, and thus it is presumed that when the dissolved oxygen reacts with the isopropyl alcohol and is consumed, the oxygen in the gaseous phase portion in the container is dissolved in the isopropyl alcohol and reacts with the isopropyl alcohol. Then, the reaction between the oxygen and the isopropyl alcohol also by-produces hydrogen peroxide in addition to acetone, and the hydrogen peroxide also reacts with the isopropyl alcohol. Therefore, it is presumed that the content of the organic impurities such as acetone increases until the oxygen in the accommodating body is almost consumed during long-term storage. The inside of the container such as an ISO tank container is made of stainless steel or the like, and the stainless steel usually contains

chromium. It is presumed that, under the influence of the oxygen in the container and the by-produced hydrogen peroxide, the chromium contained in the stainless steel is eluted in an extremely small amount, and the content of chromium in the isopropyl alcohol also increases. Further, it is presumed that the chromium eluted into the isopropyl alcohol acts as a catalyst when the oxygen reacts with the isopropyl alcohol, and that the chromium has an action of promoting an increase in the content of organic impurities such as acetone during storage.

[0041]

Therefore, it is presumed that by accommodating the isopropyl alcohol in the container and setting the oxygen content in the container when the gaseous phase portion is filled with the inert gas such as nitrogen gas to a predetermined range, the increase in the content of the metal impurities such as chromium or the content of the organic impurities such as acetone during long-term storage is prevented, and the content of the metal impurities such as chromium or the content of the organic impurities such as acetone during long-term storage can be controlled, thereby making the long-term storage for several tens of days to several months become possible.

[0042]

(Oxygen Content in Accommodating Body)

In the accommodating body of the present disclosure, the

oxygen content in the container needs to be 0.001 ppm by mol to 0.100 ppm by mol with respect to the isopropyl alcohol. From the viewpoint of the effect of preventing the increase in the content of the metal impurities such as chromium or the content of the organic impurities such as acetone during long-term storage, the oxygen content in the container is preferably 0.001 ppm by mol to 0.050 ppm by mol, and more preferably 0.001 ppm by mol to 0.010 ppm by mol, with respect to the isopropyl alcohol.

[0043]

The oxygen content in the container can be determined by measuring an oxygen amount in the gaseous phase portion of the accommodating body and a dissolved oxygen amount in the isopropyl alcohol in the liquid phase portion, and calculating a total amount of oxygen. The oxygen content can be determined as a molar fraction with respect to the isopropyl alcohol based on the calculated oxygen content and an amount of isopropyl alcohol in the accommodating body.

[0044]

Here, after sampling the gaseous phase portion and measuring an oxygen amount in the sample by using a known oxygen analysis method, the oxygen amount in the gaseous phase portion can be calculated based on the oxygen amount in the sample and a volume and an internal pressure of the gaseous phase portion of the accommodating body. Examples of the known oxygen analysis method include a gas chromatography (GC) method using a pulse discharge type photoionization detector,

a polarographic method, and an optical oxygen analysis method (analysis method utilizing luminescence and quenching phenomena of a fluorescent substance).

[0045]

Further, after sampling the isopropyl alcohol in the liquid phase portion and measuring an oxygen amount in the sample by using the polarographic method or the optical oxygen analysis method (analysis method utilizing luminescence and quenching phenomena of a fluorescent substance), the dissolved oxygen amount in the isopropyl alcohol of the liquid phase portion can be calculated based on the dissolved oxygen amount in the sample and a volume of the isopropyl alcohol in the accommodating body.

[0046]

(Content of Acetone as Impurity in Isopropyl Alcohol)

In the accommodating body of the present disclosure, the content of acetone as an impurity in the isopropyl alcohol is 10 ppb to 200 ppb. When the content of acetone in the isopropyl alcohol falls within the above range, the accommodated isopropyl alcohol can be suitably used as a cleaning liquid or a drying liquid for a semiconductor device. From the viewpoint of reducing the influence on the device in the case in which the accommodated isopropyl alcohol is used as the cleaning liquid or the drying liquid of the semiconductor device, the content of acetone in the isopropyl alcohol is preferably 10 ppb to 200 ppb, and more preferably

10 ppb to 100 ppb.

[0047]

The content of acetone in the isopropyl alcohol can be measured by using gas chromatography-mass spectrometry (GC-MS) after sampling the isopropyl alcohol in the liquid phase portion of the accommodating body.

[0048]

(Content of Chromium as Impurity in Isopropyl Alcohol)

As described above, it is presumed that the chromium eluted into the isopropyl alcohol acts as a catalyst when the oxygen reacts with the isopropyl alcohol. From the viewpoint of preventing the increase in the content of the organic impurities such as acetone during long-term storage and controlling the content of the organic impurities, the content of chromium in the isopropyl alcohol is preferably 0.01 ppt to 2.50 ppt, and more preferably 0.01 ppt to 1.00 ppt.

[0049]

The content of chromium in the isopropyl alcohol can be measured by using inductively coupled plasma-mass spectrometry (ICP-MS) after sampling the isopropyl alcohol in the liquid phase portion of the accommodating body.

[0050]

(Isopropyl Alcohol)

The isopropyl alcohol to be accommodated in the container is not particularly limited as long as it is isopropyl alcohol

having the above acetone content after being accommodated in the container. From the viewpoint of reducing the influence on the device in the case in which the accommodated isopropyl alcohol is used as the cleaning liquid or the drying liquid of the semiconductor device, a purity of the isopropyl alcohol is preferably 99.99% or more, and more preferably 99.9999% or more. In addition, from the viewpoint of the effect of preventing the increase in the content of the organic impurities such as acetone during long-term storage, the isopropyl alcohol preferably satisfies the following conditions: a concentration of dissolved oxygen, an acetone content, and a chromium content.

[0051]

The concentration of dissolved oxygen in the isopropyl alcohol is preferably 0.001% to 0.050%, and more preferably 0.001% to 0.025%, with respect to an oxygen saturation solubility at 25°C in the atmosphere. The concentration of dissolved oxygen in the isopropyl alcohol can be determined by measuring the dissolved oxygen amount in the liquid phase portion of the accommodating body by using the above method, measuring an oxygen partial pressure corresponding to the dissolved oxygen present in the isopropyl alcohol at 25°C in the atmosphere, dividing the measured oxygen partial pressure by an oxygen partial pressure at 25°C in the atmosphere, and converting the divided oxygen partial pressure into a percentage.

[0052]

Here, "in the atmosphere" means under air composition at 1 atmosphere. In addition, "the oxygen partial pressure at 25°C in the atmosphere" means an oxygen partial pressure in the air at 25°C in 1 atmosphere, which is 21 kPa. Further, in the present disclosure, the oxygen saturation solubility at 25°C in the atmosphere is an oxygen concentration when the dissolved oxygen reaches equilibrium in an atmosphere of 1 atmosphere and an oxygen partial pressure of 21 kPa.

[0053]

The oxygen saturation solubility to the isopropyl alcohol varies depending on documents. For example, based on the reference document (Sato et al., Ltd., "Solubility of Oxygen in Organic Solvents and Calculation of the Hansen Solubility Parameters of Oxygen", Industrial and Engineering Chemistry Research (Ind. Eng. Chem. Res.), 2014, Vol. 53, pages 19831 to 19837), the oxygen saturation solubility to the isopropyl alcohol at 25°C under an atmosphere of an oxygen partial pressure of 101.3 kPa is 7.78×10^{-4} mol/mol. When the concentration of dissolved oxygen in the isopropyl alcohol is 0.001% to 0.050% with respect to the oxygen saturation solubility at 25°C in the atmosphere, the concentration of dissolved oxygen in the isopropyl alcohol can be calculated to be 0.9 ppb to 43.5 ppb.

[0054]

The content of acetone contained as an impurity in the isopropyl alcohol is preferably 10 ppb to 200 ppb, and more preferably 10 ppb to 100 ppb. The content of acetone in the

isopropyl alcohol can be measured by using the same method as the method for measuring acetone in the liquid phase portion of the accommodating body.

[0055]

Among the metal impurities contained in the isopropyl alcohol, the content of chromium is preferably 0.01 ppt to 2.50 ppt, and more preferably 0.01 ppt to 1.00 ppt. The content of chromium in the isopropyl alcohol can be measured by using the same method as the method for measuring chromium in the liquid phase portion of the accommodating body.

[0056]

As the isopropyl alcohol to be accommodated in the container, isopropyl alcohol obtained by using a known manufacturing method can be used. Examples of the known manufacturing method include an acetone reduction method for reducing acetone, a Veba Chemie method which is a gaseous phase method of a fixed bed catalyst method, a Deutsche Texaco method which is a gaseous liquid mixed phase method of a fixed bed catalyst method, and a direct hydration method. Among these manufacturing methods, the direct hydration method is preferred in terms of obtaining high-purity isopropyl alcohol and facilitating purification.

[0057]

As a method for purifying the isopropyl alcohol obtained by using the above method, a known method can be adopted. Specific examples thereof include a method for purifying isopropyl alcohol by distillation, a method for filtering

isopropyl alcohol through a filter, and a combination of these methods. In the case of using the isopropyl alcohol as the cleaning liquid or the drying liquid of the semiconductor device, it is necessary to use isopropyl alcohol that does not contain fine particles or the like with high purity, and it is preferred to adopt a method of combining distillation and filtration as the purification method.

[0058]

(Container of Accommodating Body)

As a container that accommodates isopropyl alcohol, any container known as a container for accommodating an organic chemical liquid can be used without any particular limitation. A volume of the container is, for example, in a range of 10 L to 1,500,000 L. Specific examples of such a container include a canister can (volume: 18 L to 200 L), an intermediate bulk container (IBC) (volume: 1,000 L to 2,000 L), a tank lorry (volume: 2,000 L to 4,000 L), an ISO tank container (volume: 13,000 L to 26,000 L), and a storage tank (volume: 100,000 L to 1,500,000 L). In particular, the container of the present disclosure is preferably a container (intermediate bulk container, tank lorry, ISO tank container, storage tank, or the like) having a volume in the range of 1,000 L to 1,500,000 L. In such a container having a large internal volume, oxygen often remains in the gaseous phase portion when an inert gas such as nitrogen gas is sealed in after the container is filled with isopropyl alcohol. In this regard, by managing an

oxygen content in the container to be within the predetermined range as in the present disclosure, the increase in the content of the metal impurities such as chromium or the content of the organic impurities such as acetone during long-term storage is prevented, and the content of the metal impurities such as chromium or the content of the organic impurities such as acetone during long-term storage can be controlled, thereby making the long-term storage for several tens of days to several months become possible.

[0059]

From the viewpoint of the effect of preventing an increase in an amount of impurities in the isopropyl alcohol accommodated in the container, a material of a portion of the container that comes into contact with the isopropyl alcohol is preferably at least one selected from the group consisting of resins (polyolefin resin, fluororesin, and the like), glass, and metals (stainless steel, Hastelloy, Inconel, Monel, and the like), and more preferably stainless steel. Examples of the stainless steel include austenitic stainless steels such as SUS304 (Cr content: 18% to 20%, Ni content: 8% to 10.5%), SUS304L (Cr content: 18% to 20%, Ni content: 9% to 13%), SUS316 (Cr content: 16% to 18%, Ni content: 10% to 14%), and SUS316L (Cr content: 16% to 18%, Ni content: 12% to 15%).

[0060]

As described above, it is presumed that the chromium eluted into the isopropyl alcohol acts as a catalyst when the oxygen reacts with the isopropyl alcohol. When the stainless

steel such as SUS304 is used as the material of the container, it is preferred to apply a passivation treatment for forming a passivation layer on a surface of the stainless steel in order to prevent the elution of metal components such as chromium into the isopropyl alcohol. By applying the passivation treatment to the portion that comes into contact with the isopropyl alcohol, it is possible to prevent an increase in the content of the metal impurities in the isopropyl alcohol in the storage, filling, or transport step. A known method can be used as the passivation treatment.

[0061]

An amount of isopropyl alcohol accommodated in the container may be appropriately determined in consideration of the purpose of accommodation. In consideration of the volatility of the isopropyl alcohol, a transport cost, and the like, the isopropyl alcohol is preferably accommodated in a range of 2% to 98% of the volume of the container, and more preferably in a range of 80% to 98%.

[0062]

<Method for Manufacturing Accommodating Body>

A method for manufacturing an isopropyl alcohol accommodating body according to the present disclosure includes: setting an oxygen concentration in a gas in a container to 0.1 ppm by vol to 10 ppm by vol when isopropyl alcohol is accommodated in the container. According to such a manufacturing method, it is possible to control a content of

metal impurities such as chromium or a content of organic impurities such as acetone during long-term storage, and it is possible to manufacture the accommodating body capable of performing long-term storage for several tens of days to several months. From the viewpoint of controlling the increase in the content of the metal impurities such as chromium or the content of the organic impurities such as acetone during long-term storage, the oxygen concentration in the gas in the container when the isopropyl alcohol is accommodated in the container is preferably 0.1 ppm by vol to 5 ppm by vol, more preferably 0.1 ppm by vol to 1 ppm by vol, and further preferably 0.1 ppm by vol to 0.5 ppm by vol.

[0063]

In addition, the isopropyl alcohol may be once accommodated in a storage tank (first container) and then further accommodated in an ISO tank container or the like (second container). When the isopropyl alcohol is transferred to the second container, by carrying out the manufacturing method of the present disclosure, it is also possible to control the content of the metal impurities such as chromium or the content of the organic impurities such as acetone during long-term storage for the isopropyl alcohol accommodated in the second container, thereby making the long-term storage for several tens of days to several months become possible.

[0064]

Hereinafter, as an example of the manufacturing method of

the present disclosure, a method of accommodating isopropyl alcohol subjected to a purification step in a storage tank and then transferring to the accommodated isopropyl alcohol in an ISO tank container will be described.

[0065]

(Accommodation of Isopropyl Alcohol in Storage Tank)

In the manufacturing method of the present disclosure, a liquid feed line for feeding the isopropyl alcohol from the purification step to the storage tank and a gas supply line for supplying an inert gas to the storage tank are connected to the storage tank. The isopropyl alcohol is accommodated in the storage tank via the liquid feed line, and the inert gas is sealed in the storage tank via the gas supply line.

[0066]

As the inert gas, a stable inert gas such as nitrogen gas or argon gas can be used, and it is preferred to use nitrogen gas from the viewpoint that an inert gas with high purity is industrially available at low cost. The purity of the inert gas is preferably 99.999% or more. An oxygen concentration in the inert gas is preferably 5 ppm by vol or less, more preferably 0.5 ppm by vol or less, and further preferably 0.1 ppm by vol or less.

[0067]

In the manufacturing method of the present disclosure, from the viewpoint of preventing the increase in the amount of impurities in the isopropyl alcohol, a material of transfer

tubes used for the liquid feed line and the gas supply line is preferably the same as the material of the container described above. Specifically, the stainless steel or the fluororesin (PFA, PTFE, or the like) is preferable. Examples of the stainless steel include SUS304, SUS304L, SUS316, and SUS316L. As described above, the stainless steel can be subjected to the passivation treatment.

[0068]

Before the isopropyl alcohol is first fed to the storage tank, it is preferred to replace the gaseous phase portion in the storage tank with an inert gas, measure an oxygen concentration in the inert gas when the storage tank is filled with the inert gas, and accommodate the isopropyl alcohol in the storage tank after confirming that the oxygen concentration is 0.1 ppm by vol to 10 ppm by vol.

[0069]

A concentration of dissolved oxygen, an acetone content, and a chromium content in the isopropyl alcohol when the isopropyl alcohol is fed to the storage tank via the liquid feed line are preferably within the same preferred ranges as the concentration of dissolved oxygen of the isopropyl alcohol in the accommodating body described above.

[0070]

An amount of isopropyl alcohol accommodated in the storage tank is preferably 2% to 98% of the volume.

[0071]

Next, an inert gas is sealed in the gaseous phase portion

in the storage tank that accommodates isopropyl alcohol. An internal pressure of the gaseous phase portion in the storage tank after the inert gas is sealed in is not particularly limited, and is preferably 0.0001 MPa to 0.30 MPa.

[0072]

After the inert gas is sealed in, the gaseous phase portion in the storage tank is sampled to measure an oxygen concentration, and if the oxygen concentration is 0.1 ppm by vol to 10 ppm by vol, the storage tank can be used as the accommodating body of the present disclosure. When the oxygen concentration in the gaseous phase portion is not in the above range, the accommodating body of the present disclosure can be manufactured by replacing the gaseous phase portion with a supplied inert gas until the oxygen concentration in the gaseous phase portion falls within the above range.

Alternatively, the accommodating body of the present disclosure can be manufactured by discharging the accommodated isopropyl alcohol, washing the inside of the storage tank, confirming the airtightness of pipes (liquid feed line, gas supply line, and other equipment), and accommodating the isopropyl alcohol again.

[0073]

A temperature when the isopropyl alcohol is stored in the accommodating body is not particularly limited, and may be usually set appropriately within a range of -20°C to 50°C from the viewpoint of preventing an increase in a content of impurities during long-term storage.

[0074]

(Transferring of Isopropyl Alcohol in Storage Tank to ISO Tank Container)

Next, a method for manufacturing the accommodating body of the present disclosure in which the isopropyl alcohol in the storage tank is transferred to the ISO tank container will be described.

[0075]

The used ISO tank container may be used again as the ISO tank container. In such a case, it is preferred to co-wash the ISO tank container with isopropyl alcohol before the isopropyl alcohol is accommodated.

[0076]

Normally, the storage tank and the ISO tank container are not connected and are independent from each other. Therefore, in order to feed the isopropyl alcohol from the storage tank to the ISO tank container, the transfer tube of the liquid feed line for feeding the isopropyl alcohol in the storage tank and the transfer tube of the gas supply line for supplying the inert gas to the ISO tank container are connected to the ISO tank container.

[0077]

A known method can be used for the connection between the ISO tank container and the transfer tube of the liquid feed line and the transfer tube of the gas supply line. The ISO tank container is provided with a joint in order to connect to

the transfer tube of the liquid feed line and the transfer tube of the gas supply line. A joint provided in the transfer tube of the liquid feed line and a joint provided in the transfer tube of the gas supply line are connected to the joint provided in the ISO tank container. Examples of the type of the joint include a lever type joint and a quick fluid joint. A flexible hose may be used for the liquid feed line and the gas supply line.

[0078]

As a cause of an increase in the oxygen concentration in the isopropyl alcohol with which the ISO tank container is filled, when the joint provided in the ISO tank container is connected to the joint provided in the transfer tube of the liquid feed line and the joint provided in the transfer tube of the gas supply line, or when the connection between the joints is not sealed and there is a gap therebetween, air may be mixed into the lines, and oxygen may be dissolved in the isopropyl alcohol in the container. Therefore, it is preferred to provide a vent exhaust line in the gas supply line, purge the inside of the line by pressurizing an inert gas, and sufficiently replace an atmosphere in the gas supply line and the ISO tank container until the oxygen concentration falls within a predetermined range.

[0079]

Before the ISO tank container is filled with the isopropyl alcohol, the residual isopropyl alcohol in the ISO tank container is preferably discharged to the outside of the

ISO tank container by pressurizing the inert gas from the gas supply line.

[0080]

Then, the isopropyl alcohol in the storage tank is fed to the ISO tank container via the liquid feed line. At this time, an amount of isopropyl alcohol accommodated in the ISO tank container is preferably 2% to 98% of the volume.

[0081]

Next, an inert gas is sealed in the gaseous phase portion in the ISO tank container filled with the isopropyl alcohol. The gaseous phase portion in the ISO tank container after the inert gas is sealed in preferably has an internal pressure of 0.01 MPa to 0.30 MPa, more preferably 0.02 MPa to 0.12 MPa, and further preferably 0.02 MPa to 0.07 MPa.

[0082]

After the inert gas is sealed in, the gaseous phase portion in the ISO tank container is sampled to measure an oxygen concentration, and if the oxygen concentration is 0.1 ppm by vol to 10 ppm by vol, the ISO tank container can be used as the accommodating body of the present disclosure. When the oxygen concentration in the gaseous phase portion is not in the above range, the accommodating body of the present disclosure can be manufactured by replacing the gaseous phase portion with a supplied inert gas until the oxygen concentration in the gaseous phase portion falls within the above range. Alternatively, the accommodating body of the present disclosure can be manufactured by discharging the

accommodated isopropyl alcohol, washing the inside of the ISO tank container, confirming the airtightness of the pipes (liquid feed line, gas supply line, and other equipment), and accommodating the isopropyl alcohol again. The discharged isopropyl alcohol is analyzed for the concentration of dissolved oxygen, the acetone content, and the chromium content, and if all of the concentration of dissolved oxygen, the acetone content, and the chromium content are in the preferred ranges, the discharged isopropyl alcohol can be used as isopropyl alcohol to be accommodated again in the ISO tank container. On the other hand, when the concentration of dissolved oxygen, the acetone content, and the chromium content are not in the preferred ranges, the isopropyl alcohol can be purified by using a known purification method and then used as the isopropyl alcohol accommodated in the ISO tank container.

[0083]

Although the method of feeding the isopropyl alcohol in the storage tank to the ISO tank container has been described above, the manufacturing method of the present disclosure is not limited to those embodiments, and a canister can or the like may be used as a container.

[0084]

The canister can be co-washed in the following procedure. That is, the present invention can be implemented by filling the container with the isopropyl alcohol from the liquid feed line in an amount of 1% to 10% of the volume of the container

and co-washing the container, and after the co-washing, discharging the residual isopropyl alcohol in the container to the outside of the container by pressurizing the inert gas from the gas supply line. The co-washing is not limited to one time and may be performed a plurality of times.

[0085]

The intermediate bulk container, the tank lorry, and the ISO tank container can be co-washed in the following procedure. First, a container is supplied with pure water that passes through a filter, is filled with the pure water until the pure water overflows from the container, and is washed with the pure water. After standing for 15 minutes, the pure water in the container is discharged to the outside of the container by pressurizing the inert gas from the gas supply line. The container is filled with the isopropyl alcohol from the liquid feed line in the amount of 1% to 10% of the volume of the container and is co-washed, and after the co-washing, the residual isopropyl alcohol in the container is discharged to the outside of the container by pressurizing the inert gas from the gas supply line. The co-washing is not limited to one time and may be performed a plurality of times. When the container is filled with only the isopropyl alcohol and sealed with an inert gas after being co-washed a plurality of times, the pure water washing and the co-washing of the container may not be necessarily performed.

[0086]

<Quality Control Method for Accommodating Body>

As described above, it is presumed that when the oxygen is present in the gaseous phase portion of the accommodating body, the content of the metal impurities such as chromium or the content of the organic impurities such as acetone increases until most of the oxygen in the accommodating body is consumed during long-term storage. Therefore, by measuring the oxygen concentration in the gaseous phase portion of the accommodating body and the concentration of dissolved oxygen in the isopropyl alcohol of the liquid phase portion and managing the concentrations to be within a predetermined range, the increase in the content of the metal impurities such as chromium or the content of the organic impurities such as acetone during long-term storage is prevented, and the content of the metal impurities such as chromium or the content of the organic impurities such as acetone during long-term storage can be controlled, thereby making the long-term storage for several tens of days to several months become possible.

[0087]

In a case in which the oxygen concentration is not in a range of 0.1 ppm by vol to 10 ppm by vol in a measurement of the oxygen concentration in the gaseous phase portion of the accommodating body, or in a case in which the concentration of dissolved oxygen is not in a range of 0.001% to 0.050% with respect to an oxygen saturation solubility at 25°C in the atmosphere in a measurement of the concentration of dissolved

oxygen in the isopropyl alcohol of the liquid phase portion, the following method is performed as the quality control method. First, the isopropyl alcohol in the container is discharged, and the inside of the container is purged with an inert gas. At this time, it is confirmed that there is no leakage in the joints between the container and the transfer tubes. Next, after it is confirmed that when the oxygen concentration in the gaseous phase portion in the container is measured, the oxygen concentration is within the range of 0.1 ppm by vol to 10 ppm by vol, the container is again filled with the isopropyl alcohol purified by using the above method. After the filling, it is confirmed that when the oxygen concentration in the gaseous phase portion in the container is measured, the oxygen concentration is within the range of 0.1 ppm by vol to 10 ppm by vol, and that when the concentration of dissolved oxygen in the isopropyl alcohol in the container is measured, the concentration of dissolved oxygen is 0.001% to 0.050% with respect to the oxygen saturation solubility at 25°C in the atmosphere.

[0088]

The oxygen concentration in the isopropyl alcohol accommodating body can be managed in the above procedure. The accommodating body can also prevent an increase in the content of the organic impurities and the chromium content in the isopropyl alcohol during storage or transportation. The isopropyl alcohol in the accommodating body can be stored for a long period of time, and can be suitably used as a cleaning

liquid or a drying liquid for a semiconductor device.

[0089]

In the isopropyl alcohol in the accommodating body, not only the increase in the acetone content but also an increase in a content of an organic acid or the like in the organic impurities can be prevented.

EXAMPLES

[0090]

Hereinafter, the present invention will be described in detail with reference to Examples, and the present invention is not limited to these Examples.

[0091]

<Oxygen Content in Isopropyl Alcohol Accommodating Body>

An oxygen content of the gaseous phase portion of the isopropyl alcohol accommodating body was calculated as follows. First, nitrogen having a purity of 99.999% or more and an oxygen concentration of 1 ppm by vol or less, and nitrogen having an oxygen concentration adjusted to 1,000 ppm by vol were measured and calibrated in advance using an optical oxygen concentration meter (manufactured by PreSens, Fibox 4 trace (sensor: Pst6)). Next, a value of the internal pressure of the gaseous phase portion of the accommodating body was confirmed from a pressure gauge disposed in the accommodating body, the gaseous phase portion of the accommodating body was pumped to the optical oxygen

concentration meter due to the internal pressure of the gaseous phase portion of the accommodating body, and the gaseous phase portion of the accommodating body was purged for 1 minute to measure the oxygen concentration in the gaseous phase portion of the accommodating body. Finally, an oxygen amount in the gaseous phase portion of the accommodating body was calculated according to an expression of (oxygen concentration in gaseous phase portion of accommodating body $\times$ (atmospheric pressure + internal pressure) $\div$ atmospheric pressure $\times$ molar volume of gas $\times$ volume of gaseous phase portion).

[0092]

The oxygen amount in the liquid phase portion in the accommodating body was calculated as follows. First, the nitrogen having a purity of 99.999% or more and an oxygen concentration of 1 ppm by vol or less, and the nitrogen having an oxygen concentration adjusted to 1,000 ppm by vol were measured and calibrated in advance using the optical oxygen concentration meter (manufactured by PreSens, Fibox 4 trace (sensor: Pst6)). Next, the liquid phase portion of the accommodating body was pumped to the optical oxygen concentration meter due to the internal pressure of the gaseous phase portion of the accommodating body, and the liquid phase portion of the accommodating body was purged for 1 minute to measure the oxygen concentration in the liquid phase portion of the accommodating body. Finally, the oxygen amount in the liquid phase portion of the accommodating body

was calculated according to an expression of (oxygen concentration of liquid phase portion of accommodating body ÷ molar mass of oxygen × weight of liquid phase portion).

[0093]

A total amount of oxygen in the gaseous phase portion and the liquid phase portion of the accommodating body was defined as an oxygen content in the container. A molar fraction of the oxygen content in the container to the isopropyl alcohol was calculated according to an expression (oxygen content in container ÷ weight of liquid phase portion × molar mass of isopropyl alcohol).

[0094]

<Acetone Content in Isopropyl Alcohol Accommodating Body>

An acetone content in the isopropyl alcohol accommodating body was measured by using the GC-MS (gas chromatography-mass spectrometry) under the following measurement conditions with a selected ion monitoring method (SIM). A calibration curve of the acetone content according to the same measurement conditions was prepared in advance, the acetone content in the measured sample was determined based on the calibration curve, and converted into an amount of isopropyl alcohol in the accommodating body to be defined as the acetone content in the isopropyl alcohol accommodating body.

-Measurement Conditions-

Apparatus: GCMS-QP2010 Ultra (manufactured by Shimadzu Corporation)

Column: CP-WAX 52CB (60 m × 0.25 mm, 0.50 μm)

Carrier gas: helium

Carrier gas flow rate: 0.98 mL/min

Inlet temperature: 150°C

Column temperature: 75°C

Detector temperature: 230°C

Injection mode: split method

Split ratio: 1:10

SIM mode set ion: m/Z = 43

[0095]

<Chromium Content in Isopropyl Alcohol Accommodating Body>

An amount of metal impurities contained in the isopropyl alcohol was quantified using the ICP-MS (inductively coupled plasma-mass spectrometry) as follows. About 500 mL of the isopropyl alcohol was collected in an eggplant-shaped flask, concentrated and dried with a rotary evaporator, and then recovered twice with about 25 mL of 0.1 N nitric acid. A metal elution amount of the recovered 0.1 N nitric acid solution was quantified using ICP-MS (Agilent 8900 manufactured by Agilent Technologies). At this time, a concentration magnification was calculated based on a ratio of a weight of the isopropyl alcohol before concentration to a weight of the 0.1 N nitric acid solution after collection, and converted into an amount of metal impurities per unit weight of the isopropyl alcohol.

[0096]

<Example 1>

The isopropyl alcohol subjected to the purification step was accommodated in the storage tank by using the following method. First, before the isopropyl alcohol is fed to the storage tank, the gaseous phase in the storage tank was replaced with nitrogen via the gas supply line. A purity of the nitrogen used at this time was 99.999% or more, and the oxygen concentration was 5 ppm by vol or less. After the gaseous phase replacement, an oxygen content in the accommodating body was measured, and an oxygen concentration in the gaseous phase portion in the storage tank was 1 ppm by vol or less. Next, the isopropyl alcohol subjected to the purification step was accommodated in the storage tank via the liquid feed line. An amount of isopropyl alcohol accommodated in the storage tank was 80% of the internal volume. Next, nitrogen was sealed via the gas supply line in the gaseous phase portion of the storage tank that accommodates the isopropyl alcohol. After the nitrogen was sealed in, an internal pressure of the gaseous phase portion in the storage tank was 0.0005 MPa.

[0097]

After the nitrogen was sealed in the gaseous phase portion in the storage tank to manufacture an isopropyl alcohol accommodating body, and when an oxygen content in the accommodating body was measured, the oxygen concentration in the gaseous phase portion of the accommodating body was 1.0 ppm by vol, a concentration of dissolved oxygen in the

isopropyl alcohol accommodated in the accommodating body was 0.024% with respect to an oxygen saturation solubility at 25°C in the atmosphere, and a molar fraction of the oxygen content in the accommodating body to the isopropyl alcohol was 0.040 ppm by mol. The accommodating body had an acetone content of 10 ppb and a chromium content of 0.19 ppt.

[0098]

The accommodating body thus manufactured was stored in a temperature range of 15°C to 30°C for 30 days. When the oxygen content in the accommodating body after storage was measured, the oxygen concentration in the gaseous phase portion of the accommodating body was 0.7 ppm by vol, the concentration of dissolved oxygen in the isopropyl alcohol accommodated in the accommodating body was 0.016% with respect to the oxygen saturation solubility at 25°C in the atmosphere, and the molar fraction of the oxygen content in the accommodating body to the isopropyl alcohol was 0.027 ppm by mol. The accommodating body had an acetone content of 46 ppb and a chromium content of 0.64 ppt.

[0099]

<Comparative Example 1>

The isopropyl alcohol subjected to the purification step was accommodated in the storage tank by using the following method. First, the isopropyl alcohol subjected to the purification step was accommodated in the storage tank via the liquid feed line. An amount of isopropyl alcohol accommodated

in the storage tank was 80% of the internal volume. Next, nitrogen was sealed via the gas supply line in the gaseous phase portion of the storage tank that accommodates the isopropyl alcohol. A purity of the nitrogen used at this time was 99.999% or more, and an oxygen concentration was 5 ppm by vol or less. After the nitrogen was sealed in, an internal pressure of the gaseous phase portion in the storage tank was 0.0005 MPa.

[0100]

The accommodating body thus manufactured was stored in the temperature range of 15°C to 30°C for 51 days. Storage conditions of the accommodating body are shown in Table 1, and an oxygen content, an acetone content, and a chromium content in the accommodating body before and after storage are shown in Table 2.

[0101]

<Example 2>

The isopropyl alcohol in the storage tank was accommodated in the ISO tank container by using the following method. First, the joints provided in the transfer tube of the liquid feed line and the transfer tube of the gas supply line that are connected to the storage tank were connected to the joint of the ISO tank container. The inside of the gas supply line was purged for 5 minutes by pressurizing nitrogen to the vent exhaust line. A purity of the nitrogen used at this time was 99.999% or more, and an oxygen concentration was 5 ppm by

vol or less. In addition, it was confirmed that there is no leakage in a joint portion of the transfer tube. After the gaseous phase displacement, it was confirmed that the oxygen concentration in the gas supply line is 1 ppm by vol or less. Next, before the isopropyl alcohol is fed to the ISO tank container, the residual isopropyl alcohol in the ISO tank container was discharged to the outside of the ISO tank container by pressurizing the nitrogen from the gas supply line. After the isopropyl alcohol is discharged, it was confirmed that the oxygen concentration in the gaseous phase portion in the ISO tank container is 1 ppm by vol or less. Next, the isopropyl alcohol in the storage tank was accommodated in the ISO tank container via the liquid feed line. An amount of isopropyl alcohol accommodated in the ISO tank container was 87% of the internal volume. Next, nitrogen was sealed via the gas supply line in the gaseous phase portion of the ISO tank container that accommodates the isopropyl alcohol. After the nitrogen was sealed in, an internal pressure of the gaseous phase portion in the ISO tank container was 0.07 MPa.

[0102]

The accommodating body thus manufactured was stored in the temperature range of 15°C to 30°C for 20 days. Storage conditions of the accommodating body are shown in Table 1, and an oxygen content, an acetone content, and a chromium content in the accommodating body before and after storage are shown in Table 2.

[0103]

<Comparative Example 2>

The isopropyl alcohol in the storage tank was accommodated in the ISO tank container by using the following method. First, the joints provided in the transfer tube of the liquid feed line and the transfer tube of the gas supply line that are connected to the storage tank were connected to the joint of the ISO tank container. However, the inside of the lines were not purged by pressurizing nitrogen. Next, before the isopropyl alcohol is fed to the ISO tank container, the residual isopropyl alcohol in the ISO tank container was discharged to the outside of the ISO tank container by pressurizing the nitrogen from the gas supply line. A purity of the nitrogen used at this time was 99.999% or more, and an oxygen concentration was 5 ppm by vol or less. Next, the isopropyl alcohol in the storage tank was accommodated in the ISO tank container via the liquid feed line. An amount of isopropyl alcohol accommodated in the ISO tank container was 87% of the internal volume. Next, nitrogen was sealed via the gas supply line in the gaseous phase portion of the ISO tank container that accommodates the isopropyl alcohol. After the nitrogen was sealed in, an internal pressure of the gaseous phase portion in the ISO tank container was 0.06 MPa.

[0104]

The accommodating body thus manufactured was stored in the temperature range of 15°C to 30°C for 21 days. Storage

conditions of the accommodating body are shown in Table 1, and an oxygen content, an acetone content, and a chromium content in the accommodating body before and after storage are shown in Table 2.

[0105]

<Example 3>

The isopropyl alcohol in the storage tank was transferred to the canister can by using the following method. First, the joints provided in the transfer tube of the liquid feed line and the transfer tube of the gas supply line that are connected to the storage tank were connected to the joint of the canister can. The canister can was filled with the isopropyl alcohol in an amount of 1% to 10% of the volume of the canister can via the liquid feed line and was co-washed, and after the co-washing, the residual isopropyl alcohol in the canister can was discharged to the outside of the container by pressurizing nitrogen from the gas supply line. The co-washing was performed three times. A purity of the nitrogen used at this time was 99.999% or more, and an oxygen concentration was 5 ppm by vol or less. In addition, it was confirmed that there is no leakage in the joint portion of the transfer tube. After the co-washing, it was confirmed that the oxygen concentration in the canister can is 1 ppm by vol or less. Next, the isopropyl alcohol in the storage tank was transferred to the canister can via the liquid feed line. An amount of isopropyl alcohol accommodated in the canister can

was 82% of the internal volume. Next, nitrogen was sealed via the gas supply line in the gaseous phase portion of the canister can that accommodates the isopropyl alcohol. After the nitrogen was sealed in, an internal pressure of the gaseous phase portion in the canister can was 0.20 MPa.

[0106]

The accommodating body thus manufactured was stored in the temperature range of 15°C to 30°C for 59 days. Storage conditions of the accommodating body are shown in Table 1, and an oxygen content, an acetone content, and a chromium content in the accommodating body before and after storage are shown in Table 2.

[0107]

<Comparative Example 3>

The isopropyl alcohol in the storage tank was transferred to the canister can by using the following method. First, the joints provided in the transfer tube of the liquid feed line and the transfer tube of the gas supply line that are connected to the storage tank were connected to the joint of the canister can. The canister can was filled with the isopropyl alcohol in an amount of 1% to 10% of the volume of the canister can via the liquid feed line and was co-washed, and after the co-washing, the residual isopropyl alcohol in the canister can was discharged to the outside of the container by pressurizing nitrogen from the gas supply line. The co-washing was performed three times. A purity of the

nitrogen used at this time was 99.999% or more, and an oxygen concentration was 5 ppm by vol or less. In addition, it was confirmed that there is no leakage in the joint portion of the transfer tube. After the co-washing, it was confirmed that the oxygen concentration in the canister can is 1 ppm by vol or less. Next, the isopropyl alcohol in the storage tank was transferred to the canister can via the liquid feed line. An amount of isopropyl alcohol accommodated in the canister can was 82% of the internal volume. Next, nitrogen was sealed via the gas supply line in the gaseous phase portion of the canister can that accommodates the isopropyl alcohol, and an internal pressure of the canister can was set to 0.05 MPa. Further, nitrogen having an oxygen concentration of 1,000 ppm by vol was sealed in, and an internal pressure of the gaseous phase portion in the canister can after the nitrogen is sealed in was set to 0.20 MPa.

[0108]

The accommodating body thus manufactured was stored in the temperature range of 15°C to 30°C for 59 days. Storage conditions of the accommodating body are shown in Table 1, and an oxygen content, an acetone content, and a chromium content in the accommodating body before and after storage are shown in Table 2.

[0109]

<Example 4>

The isopropyl alcohol in the storage tank was transferred

to the ISO tank container by using the following method. First, the joints provided in the transfer tube of the liquid feed line and the transfer tube of the gas supply line that are connected to the storage tank were connected to the joint of the ISO tank container. The inside of the gas supply line was purged for 5 minutes by pressurizing nitrogen to the vent exhaust line. A purity of the nitrogen used at this time was 99.999% or more, and an oxygen concentration was 5 ppm by vol or less. In addition, it was confirmed that there is no leakage in a joint portion of the transfer tube. After the gaseous phase displacement, it was confirmed that the oxygen concentration in the gas supply line is 1 ppm by vol or less. Next, before the isopropyl alcohol is fed to the ISO tank container, the residual isopropyl alcohol in the ISO tank container was discharged to the outside of the ISO tank container by pressurizing the nitrogen from the gas supply line. After the isopropyl alcohol is discharged, it was confirmed that the oxygen concentration in the gaseous phase portion in the ISO tank container is 1 ppm by vol or less. Next, the isopropyl alcohol in the storage tank was transferred to the ISO tank container via the liquid feed line. An amount of isopropyl alcohol accommodated in the ISO tank container was 87% of the internal volume. Next, nitrogen was sealed via the gas supply line in the gaseous phase portion of the ISO tank container that accommodates the isopropyl alcohol. After the nitrogen was sealed in, an internal pressure of the gaseous phase portion in the ISO tank

container was 0.05 MPa.

[0110]

The accommodating body thus manufactured was stored in the temperature range of 15°C to 30°C for 98 days. Storage conditions of the accommodating body are shown in Table 1, and an oxygen content, an acetone content, and a chromium content in the accommodating body before and after storage are shown in Table 2.

[0111]

<Example 5>

The isopropyl alcohol in the storage tank was transferred to the ISO tank container by using the following method. First, the joints provided in the transfer tube of the liquid feed line and the transfer tube of the gas supply line that are connected to the storage tank were connected to the joint of the ISO tank container. The inside of the gas supply line was purged for 5 minutes by pressurizing nitrogen to the vent exhaust line. A purity of the nitrogen used at this time was 99.999% or more, and an oxygen concentration was 5 ppm by vol or less. In addition, it was confirmed that there is no leakage in a joint portion of the transfer tube. After the gaseous phase displacement, it was confirmed that the oxygen concentration in the gas supply line is 5 ppm by vol or less. Next, before the isopropyl alcohol is fed to the ISO tank container, the residual isopropyl alcohol in the ISO tank container was discharged to the outside of the ISO tank

container by pressurizing the nitrogen from the gas supply line. After the isopropyl alcohol is discharged, it was confirmed that the oxygen concentration in the gaseous phase portion in the ISO tank container is 5 ppm by vol or less. Next, the isopropyl alcohol in the storage tank was transferred to the ISO tank container via the liquid feed line. An amount of isopropyl alcohol accommodated in the ISO tank container was 87% of the internal volume. Next, nitrogen was sealed via the gas supply line in the gaseous phase portion of the ISO tank container that accommodates the isopropyl alcohol. After the nitrogen was sealed in, an internal pressure of the gaseous phase portion in the ISO tank container was 0.05 MPa.

[0112]

The accommodating body thus manufactured was stored in the temperature range of 15°C to 30°C for 35 days. Storage conditions of the accommodating body are shown in Table 1, and an oxygen content, an acetone content, and a chromium content in the accommodating body before and after storage are shown in Table 2.

[0113]

[Table 1]

	Storage conditions			
	Container	Accommodated amount (%)	Number of storage days (days)	Internal pressure (MPa)
Example 1	Storage tank	80	30	0.0005
Comparative Example 1	Storage tank	80	51	0.0005
Example 2	ISO tank container	87	20	0.07
Comparative Example 2	ISO tank container	87	21	0.06
Example 3	Canister can	82	59	0.20
Comparative Example 3	Canister can	82	59	0.20
Example 4	ISO tank container	87	98	0.05
Example 5	ISO tank container	87	35	0.05

[0114]

[Table 2]

Oxygen concentration, acetone content, and chromium content in accommodating body ^{*1}					
	Oxygen concentration in gaseous phase portion (ppm by vol)	Concentration of dissolved oxygen in liquid phase portion ^{*2} (%)	Oxygen content in accommodating body ^{*3} (ppm by mol)	Acetone content (ppb)	Chromium content (ppt)
Example 1	1.0	0.024	0.040	10	0.19
	0.7	0.016	0.027	46	0.64
Comparative Example 1	420	0.227	0.736	70	0.21
Example 2	1.0	0.019	0.033	2140	36.10
	0.5	0.024	0.040	30	0.05
Comparative Example 2	0.1	0.005	0.009	90	0.10
	52	0.040	0.109	40	0.10
Example 3	8.4	0.006	0.018	210	1.20
	0.5	0.048	0.080	30	0.55
Comparative Example 3	0.1	0.024	0.041	160	0.98
	500	0.048	1.220	50	0.53
Example 4	0.1	0.024	0.042	2200	2.32
	1.0	0.058	0.095	20	0.60
Example 5	0.1	0.005	0.008	120	1.50
	5.0	0.037	0.066	60	0.50
	0.3	0.005	0.008	170	1.20

*1 The upper part shows values at the start of storage, and the lower part shows values at the end of storage.

*2 Concentration of dissolved oxygen (%) in isopropyl alcohol with respect to saturation solubility of dissolved oxygen at 25°C

*3 Molar fraction of oxygen content in container to isopropyl alcohol (ppm by mol)

[0115]

As shown in Table 2, in the accommodating bodies of Examples 1 to 5 in which the oxygen content in the accommodating body was set to 0.001 ppm by mol to 0.100 ppm by mol with respect to the isopropyl alcohol and the content of acetone as the impurity in the isopropyl alcohol was set to 10 ppb to 200 ppb on a mass basis, the increase in the acetone content and the chromium content after long-term storage for several tens of days to several months was prevented as compared with the accommodating bodies of Comparative Examples 1 to 3.

CLAIMS

[Claim 1] An isopropyl alcohol accommodating body comprising:
isopropyl alcohol accommodated in a container,
an oxygen content in the container being 0.001 ppm by mol
to 0.100 ppm by mol with respect to the isopropyl alcohol,
a content of acetone as an impurity in the isopropyl
alcohol being 10 ppb to 200 ppb on a mass basis.

[Claim 2] The isopropyl alcohol accommodating body according
to claim 1, wherein a content of chromium as an impurity in
the isopropyl alcohol is 0.01 ppt to 2.50 ppt on a mass basis.

[Claim 3] The isopropyl alcohol accommodating body according
to claim 1 or 2, wherein a volume of the container is in a
range of 1,000 L to 1,500,000 L.

[Claim 4] The isopropyl alcohol accommodating body according
to claim 3, wherein the container is an intermediate bulk
container, a tank lorry, an ISO tank container, or a storage
tank.

[Claim 5] A method for manufacturing an isopropyl alcohol
accommodating body in which isopropyl alcohol is accommodated
in a container, the method comprising:
setting an oxygen concentration in a gas in the container
to 0.1 ppm to 10 ppm on a volume basis when the isopropyl

alcohol is accommodated in the container.

[Claim 6] The method for manufacturing an isopropyl alcohol accommodating body according to claim 5, wherein a concentration of dissolved oxygen in the isopropyl alcohol to be accommodated in the container is 0.001% to 0.050% with respect to an oxygen saturation solubility at 25°C in the atmosphere.

[Claim 7] The method for manufacturing an isopropyl alcohol accommodating body according to claim 5 or 6, wherein a content of acetone as an impurity in the isopropyl alcohol to be accommodated in the container is 10 ppb to 200 ppb on a mass basis.

[Claim 8] The method for manufacturing an isopropyl alcohol accommodating body according to claim 5 or 6, wherein a content of chromium as an impurity in the isopropyl alcohol to be accommodated in the container is 0.01 ppt to 2.50 ppt on a mass basis.

[Claim 9] The method for manufacturing an isopropyl alcohol accommodating body according to claim 5 or 6, wherein a volume of the container is in a range of 1,000 L to 1,500,000 L.

[Claim 10] The method for manufacturing an isopropyl alcohol accommodating body according to claim 9, wherein the container

is an intermediate bulk container, a tank lorry, an ISO tank container, or a storage tank.

[Claim 11] A method for manufacturing an isopropyl alcohol accommodating body in which isopropyl alcohol is accommodated in a container, the method comprising:

accommodating the isopropyl alcohol in an amount of 2% to 98% of a volume of the container; and

setting an oxygen concentration in a gas in the container to 0.1 ppm to 10 ppm on a volume basis when the isopropyl alcohol is accommodated in the container.

[Claim 12] The method for manufacturing an isopropyl alcohol accommodating body according to claim 11, wherein a concentration of dissolved oxygen in the isopropyl alcohol to be accommodated in the container is 0.001% to 0.050% with respect to an oxygen saturation solubility at 25°C in the atmosphere.

[Claim 13] The method for manufacturing an isopropyl alcohol accommodating body according to claim 11 or 12, wherein a content of acetone as an impurity in the isopropyl alcohol to be accommodated in the container is 10 ppb to 200 ppb on a mass basis.

[Claim 14] The method for manufacturing an isopropyl alcohol accommodating body according to claim 11 or 12, wherein a

content of chromium as an impurity in the isopropyl alcohol to be accommodated in the container is 0.01 ppt to 2.50 ppt on a mass basis.

[Claim 15] The method for manufacturing an isopropyl alcohol accommodating body according to claim 11 or 12, wherein a volume of the container is in a range of 1,000 L to 1,500,000 L.

[Claim 16] The method for manufacturing an isopropyl alcohol accommodating body according to claim 15, wherein the container is an intermediate bulk container, a tank lorry, an ISO tank container, or a storage tank.

[Claim 17] A method for manufacturing an isopropyl alcohol accommodating body in which isopropyl alcohol accommodated in a first container is transferred to a second container, the method comprising:

setting an oxygen concentration in a gas in the second container to 0.1 ppm to 10 ppm on a volume basis when the isopropyl alcohol is accommodated in the second container.

[Claim 18] The method for manufacturing an isopropyl alcohol accommodating body according to claim 17, wherein a concentration of dissolved oxygen in the isopropyl alcohol to be accommodated in the second container is 0.001% to 0.050% with respect to an oxygen saturation solubility at 25°C in the

atmosphere.

[Claim 19] The method for manufacturing an isopropyl alcohol accommodating body according to claim 17 or 18, wherein a content of acetone as an impurity in the isopropyl alcohol to be accommodated in the second container is 10 ppb to 200 ppb on a mass basis.

[Claim 20] The method for manufacturing an isopropyl alcohol accommodating body according to claim 17 or 18, wherein a content of chromium as an impurity in the isopropyl alcohol to be accommodated in the second container is 0.01 ppt to 2.50 ppt on a mass basis.

[Claim 21] The method for manufacturing an isopropyl alcohol accommodating body according to claim 17 or 18, wherein a volume of the container is in a range of 1,000 L to 1,500,000 L.

[Claim 22] The method for manufacturing an isopropyl alcohol accommodating body according to claim 21, wherein the container is an intermediate bulk container, a tank lorry, an ISO tank container, or a storage tank.

[Claim 23] A quality control method for an isopropyl alcohol accommodating body in which isopropyl alcohol is accommodated in a container, the method comprising:

setting a concentration of dissolved oxygen in the isopropyl alcohol to 0.001% to 0.050% with respect to an oxygen saturation solubility at 25°C in the atmosphere; and setting an oxygen concentration in a gas in the container to 0.1 ppm to 10 ppm on a volume basis.