

DESCRIPTION

Title of Invention: COMPOSITE SEAL MATERIAL

Technical Field

[0001]

5 The present invention relates to a composite seal material to be used in a vacuum state and relates to, for example, a composite seal material to be used for a semiconductor manufacturing apparatus, such as a dry-etching apparatus and a plasma CVD apparatus.

10 Background Art

[0002]

 Along with the development in the electronics industry, technology of manufacturing semiconductors that are to be materials of electronic components, such as an IC (integrated
15 circuit) and a LSI (large-scale integrated circuit), has been remarkably advanced with an improvement in definition, a reduction in thickness, and the like as with those, in particular, in a personal computer and the like.

[0003]

20 Therefore, requirements for members that are to be used for semiconductor manufacturing apparatuses have become strict, and seal materials to be used in, for example, semiconductor manufacturing apparatuses, such as a dry etching apparatus and a plasma CVD apparatus, are also no

exception.

[0004]

Meanwhile, a seal material to be used for a semiconductor manufacturing apparatus needs a vacuum sealing performance as a basic performance. Depending on the mounting place of the seal material, the seal material is required to have performances, such as plasma resistance and corrosive gas resistance, in combination.

[0005]

Conventionally, as a seal material required to have the vacuum sealing performance, the plasma resistance, and, additionally, a corrosive gas resistance, a composite seal material 100 constituted, as illustrated in Fig. 10, by a first member 102 formed of fluororubber, and a second member 104 formed of a material harder than the first member 102 and constituted by a fluororesin having favorable plasma resistance and corrosive gas resistance has been used (for example, PTL 1).

[0006]

When such a composite seal material 100 is mounted in a seal groove 154 provided in one member 152 of a semiconductor manufacturing apparatus 150, for example, the first member 102 is disposed on the side of one wall 156 of the seal groove 154 located on the side of atmosphere, and the second

member 104 is disposed on the side of another wall 158 of the seal groove 154 located on a side exposed to an etching gas and plasma.

[0007]

5 In this state, as illustrated in Fig. 11, the one member 152 and another member 160 are caused to approach each other to press the composite seal material 100 between the one member 152 and the other member 160, thereby ensuring a sealing state between the one member 152 and the other member 10 160 by the first member 102 and preventing the etching gas and the plasma by the second member 104 from entering the side of the first member 102 to avoid deterioration of the first member 102 and enable the sealing performance to be maintained for a long period of time.

15 Citation List

Patent Literature

[0008]

PTL 1: JPB 5126995

Summary of Invention

20 Technical Problem

[0009]

Since the sectional shape of such a conventional composite seal material 100 is a vertically symmetrical lump shape, a strong pressing force is required to seal a gap

between the one member 152 and the other member 160, as illustrated in Fig. 11, by mounting the composite seal material 100 in the seal groove 154 of the one member 152 and causing the one member 152 and the other member 160 to approach each other.

[0010]

In other words, although the composite seal material 100 is deformed when pressed between the one member 152 and the other member 160, the reaction force thereof when being compressed is strong because of the lump shape, and it is required to press the composite seal material 100 with a strong pressing force to obtain a sealing performance of the composite seal material 100.

[0011]

Application of such a strong pressing force to the composite seal material 100 causes the second member 104 and the other wall 158 of the seal groove 154 to come into contact with each other, and, as a result of this being repeated, the second member 104 is abraded and has a possibility of generating particles.

[0012]

Generation of particles affects the sealing performance and becomes a cause of a malfunction of the semiconductor manufacturing apparatus 150. Generation of particles is thus

one of events to be desirably avoided, and a novel composite seal material has been desired in an actual situation.

[0013]

The present invention has been made in consideration of
5 such a situation, and an object of the present invention is
to provide a composite seal material that has performances,
such as a vacuum sealing performance, plasma resistance, and
corrosive gas resistance, in combination, that does not
require a strong pressing force during use, that does not
10 have a possibility of generating particles, and that is
capable of maintaining the vacuum sealing performance for a
long period of time.

Solution to Problem

[0014]

15 The present invention has been invented to solve the
above-described problems in the related art, and a composite
seal material of the present invention is

a composite seal material having an annular shape and
including a first member and a second member that are
20 adjacent to each other on left and right,

in which the first member includes

a seal body portion, and

a lip portion extending from the seal body portion
upwardly in a thickness direction of the composite seal

material, and

in which the lip portion of the first member
extends in an inclined orientation outwardly on a side
opposite to the second member adjacent thereto.

5 [0015]

In the composite seal material of the present invention,
the composite seal material is
used to seal a gap between one member and another member,
and, when the composite seal material is mounted in a seal
10 groove provided in the one member,

the first member is located on a side of one wall of the
seal groove, and the second member is located on a side of
another wall.

[0016]

15 With the provision of such a lip portion, when a sealing
performance is to be obtained by mounting the composite seal
material in the seal groove and causing the one member and
the other member to approach each other, the lip portion
first abuts the other member and can ensure a sealed state,
20 and it is thus possible to obtain the sealing performance
with a weak pressing force.

[0017]

Moreover, when the second member is to be caused to come
into contact with the other wall of the seal groove, the

second member is caused by only a weak force to come into contact with the other wall of the seal groove. Therefore, the composite seal material of the present invention has no possibility of generating particles and can maintain the vacuum sealing performance for a long period of time.

[0018]

In the composite seal material of the present invention, an inclination angle of the lip portion is within a range of 30 to 60 degrees.

10 [0019]

With such an inclination angle, when a sealing performance is to be obtained by mounting the composite seal material in the seal groove and causing the one member and the other member to approach each other, the lip portion reliably abuts the other member and is gradually tilted toward the seal body portion, and it is thus possible to reliably obtain the sealing performance with a weak pressing force.

[0020]

20 In the composite seal material of the present invention, the seal body portion of the first member is provided with

a bulge portion at a side portion on a side opposite to the second member adjacent thereto.

[0021]

With thus provided bulge portion, when the shape of the seal groove is a dovetail groove or a single dovetail groove, it is possible to reliably prevent the composite seal

5 material mounted in the seal groove from coming off from the seal groove.

[0022]

In other words, the bulge portion is fitted into a gap between an inclined surface (the one wall) and the bottom

10 wall of the seal groove, and the composite seal material can be prevented from coming off from the seal groove.

[0023]

In the composite seal material of the present invention, a bottom of the seal body portion is

15 constituted by a flat surface.

[0024]

With such a flat surface, the composite seal material favorably sits with respect to the seal groove since the bottom wall of the seal groove and the bottom of the seal

20 body portion come into surface contact with each other, and it is thus possible to reliably prevent the composite seal material from rotating in the seal groove.

[0025]

In the composite seal material of the present invention,

a bottom of the seal body portion is provided with
a recess.

[0026]

With the thus provided recess, when a sealing
5 performance is to be obtained by mounting the composite seal
material in the seal groove and causing the one member and
the other member to approach each other, the composite seal
material is pressed and deformed, and a portion of the
composite seal material is inserted into the recess.

10 [0027]

Therefore, in the state in which the recess is provided,
the reaction force of the composite seal material is weakened,
compared with a state in which the recess is not provided,
and the sealing performance can be reliably obtained with a
15 weak pressing force.

[0028]

In the composite seal material of the present invention,
the second member includes
a base portion, and
20 an extension piece extending from the base portion
upwardly in the thickness direction of the composite seal
material, and

the extension piece

extends in an inclined orientation toward the first

member adjacent thereto.

[0029]

With the thus configured second member, when a sealing performance is to be obtained by mounting the composite seal material in the seal groove and causing the one member and the other member to approach each other, the extension piece abuts the other member after the lip portion of the first member. The extension piece is, however, deformed with a weak pressing force because of the inclined orientation thereof, and the reaction force of the composite seal material can be weakened.

[0030]

In addition, at this time, the extension piece abuts both the other wall of the seal groove and the other member, and thus, an etching gas and plasma can be reliably prevented by the extension piece from entering the side of the first member.

[0031]

In the composite seal material of the present invention, an inclination angle of the extension piece is within a range of 50 to 80 degrees.

[0032]

In particular, with such an inclination angle, when a sealing performance is to be obtained by mounting the

composite seal material in the seal groove and causing the one member and the other member to approach each other, a range in which the other wall of the seal groove and the second member abut each other is widened, and the etching gas and the plasma can be reliably prevented by the extension
5 piece from entering the side of the first member.

[0033]

In the composite seal material of the present invention, a bottom of the base portion is
10 constituted by a flat surface.

[0034]

With the bottom of the base portion being such a flat surface, the composite seal material favorably sits with respect to the seal groove since the bottom and the bottom
15 wall of the seal groove come into surface contact with each other, and it is thus possible to reliably prevent the composite seal material from rotating in the seal groove.

[0035]

Further, since the range in which the bottom wall of the seal groove and the bottom of the base portion abut each
20 other is wide, it is possible to reliably prevent the etching gas and the plasma from entering the side of the first member.

[0036]

In the composite seal material of the present invention,

the base portion is provided with
an engagement projection that is to be engaged with the
first member.

[0037]

5 With the thus provided engagement projection, the second
member and the first member are reliably integrated with each
other, and it is thus possible to reliably prevent that one
of the first member and the second member comes off from the
seal groove.

10 [0038]

In addition, handling properties of the composite seal
material is favorable since the first member and the second
member are reliably integrated with each other.

[0039]

15 In the composite seal material of the present invention,
the first member is formed of an elastic member, and
the second member is formed of a material harder than
the first member.

[0040]

20 With such a configuration, it is possible to ensure a
sealing performance by the first member and prevent by the
second member, for example, the etching gas and the plasma
from entering the side of the first member. Therefore, the
single composite seal material can have performances, such as

a vacuum sealing performance, plasma resistance, and corrosive gas resistance, in combination.

[0041]

In the composite seal material of the present invention,
5 the first member and the second member are bonded to each other by an adhesive.

[0042]

With the first member and the second member being thus bonded to each other, it is possible to reliably prevent that
10 one of the members from coming off from the seal groove and from rotating.

[0043]

In the composite seal material of the present invention,
a maximum height of the composite seal material in the
15 thickness direction of the composite seal material is within a range of 1.10 to 1.70 times with respect to a maximum depth of the seal groove.

[0044]

With the maximum height within such a range, when a
20 sealing performance is to be obtained by mounting the composite seal material in the seal groove and causing the one member and the other member to approach each other, the lip portion reliably abuts the other member and can ensure the sealing performance.

[0045]

In the composite seal material of the present invention,
a maximum width from an end of the first member to an
end of the second member in a left-right direction of the
5 composite seal material is within a range of 1.01 to 1.30
times with respect to a narrowest width of the composite seal
material at an opening of the seal groove.

[0046]

With the maximum width within such a range, when the
10 seal groove is, in particular, a dovetail groove or a single
dovetail groove, the composite seal material remains in the
seal groove, and it is possible to reliably prevent the
composite seal material from coming off from the seal groove.

[0047]

15 In the composite seal material of the present invention,
the seal groove is
one of a dovetail groove, a single dovetail groove, and
a rectangular groove.

[0048]

20 With such a seal groove, the composite seal material of
the present invention can be particularly suitably used.

[0049]

In the composite seal material of the present invention,
each of the one member and the other member is a

semiconductor manufacturing apparatus.

[0050]

In particular, semiconductor manufacturing apparatuses are required to have diverse characteristics including a
5 feature of having performances, such as a vacuum sealing performance, plasma resistance, and corrosive gas resistance, in combination and a feature of not generating particles. The composite seal material of the present invention has these performances in combination and is even capable of
10 reliably preventing generation of particles.

[0051]

In the composite seal material of the present invention, a different groove is further provided on an outer side of the seal groove provided in the one member, and a spacer
15 member is disposed in the different groove.

[0052]

With the spacer member that is thus further disposed, it is possible to reliably prevent the one member and the other member from directly coming into contact with each other.
20 Therefore, it is possible to reliably prevent generation of metal particles by metal touch.

[0053]

In the composite seal material of the present invention, when the spacer member is disposed in the different

groove,

a projecting amount of the spacer member that projects from an opening of the different groove toward the other member is within a range of 0.30 to 1.00 mm.

5 [0054]

With such a projecting amount, it is possible to prevent the one member and the other member from directly coming into contact with each other and possible to reliably maintain a sealing performance required for the composite seal material,
10 for a long period of time.

Advantageous Effects of Invention

[0055]

According to the composite seal material of the present invention, it is possible to provide a composite seal
15 material that has performances, such as a vacuum sealing performance, plasma resistance, and corrosive gas resistance, in combination, that does not require a strong pressing force during use, that does not have a possibility of generating particles, and that can maintain the vacuum sealing
20 performance for a long period of time.

Brief Description of Drawings

[0056]

[Fig. 1] Fig. 1 is a schematic view of a semiconductor manufacturing apparatus in which a composite seal material of

the present invention is mounted.

[Fig. 2] Fig. 2 is an enlarged sectional view of an A-A section of the semiconductor manufacturing apparatus illustrated in Fig. 1.

5 [Fig. 3] Fig. 3 is an enlarged sectional view of a main portion of the composite seal material of the present invention.

[Fig. 4] Fig. 4 is a sectional view of a state in which the composite seal material of the present invention is
10 mounted in a seal groove and in which another member abuts a lip portion.

[Fig. 5] Fig. 5 is a sectional view of a state in which the composite seal material of the present invention is mounted in the seal groove and in which a sealing performance
15 by the composite seal material is applied by causing one member and the other member to approach each other.

[Fig. 6] Fig. 6 is sectional views of other embodiments of the composite seal material of the present invention.

[Fig. 7] Fig. 7 is a sectional view of a state in which
20 the composite seal material of the present invention is mounted in a single dovetail groove.

[Fig. 8] Fig. 8 is a sectional view of a state in which the composite seal material of the present invention is mounted in a rectangular groove.

[Fig. 9] Fig. 9 is a sectional view of a state in which a different groove is provided on the outer side of a seal groove and in which a spacer member is disposed in the different groove.

5 [Fig. 10] Fig. 10 is a sectional view of a state in which a conventional composite seal material is mounted in a seal groove.

[Fig. 11] Fig. 11 is a sectional view of a state in which a conventional composite seal material is mounted in a seal groove and in which a sealing performance by the composite seal material is applied by causing one member and another member to approach each other.

Description of Embodiments

[0057]

15 Hereinafter, an embodiment of the present invention will be described in detail on the basis of the drawings.

[0058]

As illustrated in Fig. 1 and Fig. 2, a composite seal material 10 of the present invention is mounted in a seal groove 52 provided in one member 50 of a semiconductor manufacturing apparatus 80 and is used to seal a gap between the one member 50 and another member 70.

[0059]

As a sectional shape, as illustrated in Fig. 2 and Fig.

3, in a state of being mounted in the seal groove 52 (a dovetail groove in the present embodiment), the composite seal material 10 includes a first member 20 located on the side (the side of atmosphere in the present embodiment) of one wall 54 of the seal groove 52, and a second member 40 located on the side (on the side of severe environment, such as a corrosive gas, plasma, and the like, in the present embodiment) of another wall 56 of the seal groove 52, the first member 20 and the second member 40 being coupled to each other and constituting one composite seal material 10.

[0060]

Such a first member 20 is formed of an elastic member, and, as the elastic member, for example, rubber can be presented. As the rubber, either of natural rubber and synthetic rubber may be employed, and, in particular, fluororubber is desirable.

[0061]

As the fluororubber, binary vinylidene fluoride rubber, such as a vinylidene fluoride/hexafluoropropylene copolymer, a vinylidene fluoride/trifluorochloroethylene copolymer, and a vinylidene fluoride/pentafluoropropylene copolymer, ternary vinylidene fluoride rubber, such as a vinylidene fluoride/tetrafluoroethylene/hexafluoropropylene copolymer, a vinylidene fluoride/tetrafluoroethylene/perfluoroalkyl vinyl

ether copolymer, and a vinylidene
fluoride/tetrafluoroethylene/propylene copolymer, a
tetrafluoroethylene/propylene copolymer, a
tetrafluoroethylene/perfluoroalkyl vinyl ether copolymer,
5 thermoplastic fluororubber, and the like can be presented.

[0062]

The second member 40 includes a material harder than the
first member 20 and is preferably constituted by, for example,
a synthetic resin.

10 [0063]

As the synthetic resin, one or more types of synthetic
resins selected from a fluororesin, a polyimide resin, a
polyamideimide resin, a polyetherimide resin, a polyphenylene
sulfide resin, a polybenzimidazole resin, and a
15 polyetherketone resin can be presented.

[0064]

In particular, a fluororesin is preferable, and, as the
fluororesin, a polytetrafluoroethylene (PTFE) resin, a
tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer
20 (PFA) resin, a tetrafluoroethylene-hexafluoropropylene
copolymer (FEP) resin, a tetrafluoroethylene-ethylene
copolymer (ETFE) resin, a polyvinylidene fluoride (PVDF)
resin, a polychlorotrifluoroethylene (PCTFE) resin, a
chlorotrifluoroethylene-ethylene copolymer (ECTFE) resin, a

polyvinyl fluoride (PVF) resin, and the like can be presented. Among these, the polytetrafluoroethylene (PTFE) resin is optimum in consideration of heat resistance, corrosive gas resistance, plasma resistance, and the like.

5 [0065]

The first member 20 formed of such an elastic member includes a seal body portion 22 located on the side of a bottom wall 58 of the seal groove 52 provided in the one member 50, and a lip portion 24 extending from the seal body
10 portion 22 toward an opening 60 of the seal groove 52.

[0066]

The lip portion 24 extends in an inclined orientation outwardly on a side opposite to the second member 40 adjacent thereto, and, as illustrated in Fig. 4, is a portion that
15 first comes into contact with the other member 70 when the one member 50 and the other member 70 approach each other and is a portion to which a sealing performance is applied.

[0067]

An inclination angle $\theta 1$ of the lip portion 24 is
20 preferably within a range of 30 to 60 degrees, more preferably within a range of 35 to 50 degrees, and further preferably within a range of 40 to 45 degrees.

[0068]

With such an inclination angle $\theta 1$, when a sealing

performance is to be obtained by mounting the composite seal material 10 in the seal groove 52 and causing the one member 50 and the other member 70 to approach each other, the lip portion 24 reliably comes into contact with the other member 5 70 and is gradually tilted toward the seal body portion 22, and it is thus possible to reliably obtain the sealing performance with a weak pressing force.

[0069]

The seal body portion 22 of the first member 20 is 10 provided with a bulge portion 26 at a side portion thereof on a side opposite (the side of the one wall 54) to the adjacent second member 40.

[0070]

The bulge portion 26 enables the composite seal material 15 10 mounted in the seal groove 52 to be reliably prevented from coming off from the seal groove 52.

[0071]

In other words, the bulge portion 26 is fitted into a gap between the one wall 54 and the bottom wall 58 of the 20 seal groove 52, and the composite seal material 10 can be reliably prevented from coming off from the seal groove 52.

[0072]

A bottom 28 of the seal body portion 22 is constituted by a flat surface and thereby causes the bottom wall 58 of

the seal groove 52 and the bottom 28 to surface contact with each other. Therefore, the composite seal material 10 favorably sits with respect to the seal groove 52, and it is possible to reliably prevent the composite seal material 10
5 from rotating in the seal groove 52.

[0073]

When the first member 20 is mounted in the seal groove 52, the seal body portion 22 is located in the seal groove 52, and the most part of the lip portion 24 projects from the
10 opening 60 of the seal groove 52 toward the other member 70.

[0074]

The second member 40 adjacent to the first member 20 includes a base portion 42 located on the side of the bottom wall 58, and an extension piece 44 extending from the base
15 portion 42 upwardly (toward the other member 70) in the thickness direction of the composite seal material 10.

[0075]

When such a second member 40 is mounted in the seal groove 52, the base portion 42 is located in the seal groove 52, and the most part of the extension piece 44 projects from
20 the opening 60 of the seal groove 52 toward the other member 70.

[0076]

The extension piece 44 extends in an inclined

orientation toward the adjacent first member 20, and consequently, when a sealing performance is to be obtained by mounting the composite seal material 10 in the seal groove 52 and causing the one member 50 and the other member 70 to approach each other, the extension piece 44 abuts the other member 70 after the lip portion 24 of the first member 20, as illustrated in Fig. 5. At this time, the extension piece 44 is in the inclined orientation, is thus deformed by a weak pressing force, and can weaken the reaction force of the composite seal material 10.

[0077]

In addition, at this time, the extension piece 44 abuts both the other wall 56 of the seal groove 52 and the other member 70, and it is thus possible to reliably prevent the etching gas and the plasma from entering the side of the first member 20.

[0078]

An inclination angle θ_2 of the extension piece 44 is preferably within a range of 50 to 80 degrees, more preferably within a range of 55 to 75 degrees, and further preferably within a range of 60 to 70 degrees.

[0079]

With such an inclination angle θ_2 , when a sealing performance is to be obtained by mounting the composite seal

material 10 in the seal groove 52 and causing the one member 50 and the other member 70 to approach each other, a range in which the other wall 56 of the seal groove 52 and the second member 40 abut each other is widened, and it is possible to
5 reliably prevent the etching gas and the plasma from entering the side of the first member 20.

[0080]

A thickness T3 of the extension piece 44 is preferably within a range of 5 to 15%, more preferably within a range of
10 8 to 13%, and further preferably within a range of 10 to 12% with respect to a maximum width T1 from an end of the first member 20 to an end of the second member 40 in the left-right direction of the composite seal material 10.

[0081]

15 With the thus set thickness T3 of the extension piece 44, the extension piece 44 is deformed by a weak pressing force and can weaken the reaction force of the composite seal material 10.

[0082]

20 A bottom 46 of the base portion 42 is constituted by a flat surface and thereby causes the bottom 46 of the base portion 42 and the bottom wall 58 of the seal groove 52 to surface contact with each other. Therefore, the composite seal material 10 favorably sits with respect to the seal

groove 52, and it is possible to reliably prevent the composite seal material 10 from rotating in the seal groove 52.

[0083]

5 With the bottom 46 being a flat surface, a range in which the bottom wall 58 of the seal groove 52 and the bottom 46 of the base portion 42 abut each other is widened, and it is thus possible to reliably avoid the etching gas and the plasma from entering the side of the first member 20.

10 [0084]

 The base portion 42 is further provided with an engagement projection 48 that is to be engaged with the adjacent first member 20, and the second member 40 and the first member 20 are thereby to be reliably integrated with each other. Therefore, it is possible to reliably prevent that one of the first member 20 and the second member 40 comes off from the seal groove 52.

[0085]

 In addition, it is possible to improve handling properties of the composite seal material 10 since the first member 20 and the second member 40 are reliably integrated with each other.

[0086]

 To thus integrate the first member 20 and the second

member 40 with each other with the engagement projection 48 interposed therebetween, it is favorable to additionally bond the first member 20 and the second member 40 to each other by an adhesive, preferably, by a heat-resistance adhesive.

5 [0087]

When the composite seal material 10 of the present invention is mounted in the seal groove 52 such as that illustrated in Fig. 2, a maximum height H1 of the composite seal material 10 in the thickness direction is preferably
10 within a range of 1.10 to 1.70 times, more preferably within a range of 1.20 to 1.60 times, and further preferably within a range of 1.35 to 1.40 times with respect to a maximum depth H2 of the seal groove 52.

[0088]

15 With the maximum height H1 within such a range, when a sealing performance is to be obtained by mounting the composite seal material 10 in the seal groove 52 and causing the one member 50 and the other member 70 to approach each other, the lip portion 24 reliably abuts the other member 70
20 and can obtain the sealing performance.

[0089]

The maximum width T1 from the end of the first member 20 to the end of the second member 40 in the left-right direction of the composite seal material 10 is preferably

within a range of 1.01 to 1.30 times, more preferably within a range of 1.02 to 1.20 times, and further preferably within a range of 1.04 to 1.10 times with respect to a narrowest width T2 of the composite seal material 10 at the opening 60 of the seal groove 52.

[0090]

With the maximum width T1 within such a range, when the seal groove 52 is, in particular, a dovetail groove or a single dovetail groove, the composite seal material 10 remains in the seal groove 52 and can be reliably prevented from coming off from the seal groove 52.

[0091]

After the composite seal material 10 in which the first member 20 and the second member 40 are thus configured is disposed in the seal groove 52 as illustrated in Fig. 2, when the one member 50 and the other member 70 approach each other as illustrated in Fig. 4, the lip portion 24 first abuts the other member 70, and sealing of the gap between the one member 50 and the other member 70 is started.

[0092]

Then, when the one member 50 and the other member 70 further approach each other, the lip portion 24 is tilted toward the seal body portion 22 as illustrated in Fig. 5, and the outer side of the lip portion 24 abuts the other member

70 in a large area.

[0093]

Therefore, it is possible to reliably obtain a desired sealing performance while ensuring a sealing performance
5 between the one member 50 and the other member 70 and without requiring a strong pressing force since the lip portion 24 is only tilted by the other member 70.

[0094]

At this time, the extension piece 44 of the second
10 member 40 also abuts the other member 70 and the other wall 56 of the seal groove 52 while being tilted toward the first member 20 by the other member 70, and it is thus possible to reliably avoid the etching gas and the plasma from entering the side of the first member 20.

15 [0095]

Moreover, due to the thickness of the extension piece 44 being set as mentioned above, the extension piece 44 does not strongly slide even when abutting the other wall 56 of the seal groove 52 and has no possibility of generating particles.

20 [0096]

Regarding the composite seal material 10 of the present invention, a preferable embodiment has been described above; however, the composite seal material 10 of the present invention is not limited to the aforementioned embodiment and

may be provided with, for example, as illustrated in Fig. 6(a), a recess 90 at the bottom 28 of the seal body portion 22 of the first member 20.

[0097]

5 With the thus provided recess 90, when a sealing performance is to be obtained by mounting the composite seal material 10 in the seal groove 52 and causing the one member 50 and the other member 70 to approach each other, the composite seal material 10 is pressed, and a portion of the
10 composite seal material 10 is inserted into the recess 90. Therefore, in the state in which the recess 90 is provided, the reaction force of the composite seal material 10 is weakened, compared with a state in which the recess 90 is not provided, and the sealing performance can be reliably
15 obtained with a weak pressing force.

[0098]

In addition, even an embodiment in which, as illustrated in Fig. 6(b), the shape of the bulge portion 26 of the first member 20 has a substantially triangular cross-section or in
20 which, as illustrated in Fig. 6(c), the bulge portion 26 itself is not present may be employed depending on a situation.

[0099]

Although the aforementioned embodiment has been

described by presenting an example in which the seal groove 52 is a dovetail groove, the seal groove 52 may be, alternatively, a single dovetail groove as that illustrated in Fig. 7 or a rectangular groove such as that illustrated in Fig. 8.

[0100]

Further, as illustrated in Fig. 9, a different groove 92 may be further provided on the outer side (the side of atmosphere) of the seal groove 52 provided in the one member 50, and a spacer member 94 may be disposed in the different groove 92. As a material of such a spacer member 94, PEEK (poly ether ether ketone) excellent in heat resistance, fatigue resistance, chemical resistance, hydrolysis resistance, and the like is suitable.

[0101]

When the spacer member 94 is further disposed in the different groove 92, it is possible to reliably prevent the one member 50 and the other member 70 from directly coming into contact with each other.

[0102]

In other words, when the one member 50 and the other member 70 are made of metal, metal touch can be prevented, and it is possible to reliably prevent generation of metal particles.

[0103]

When the spacer member 94 is disposed in the different groove 92, a projecting amount H3 of the spacer member 94 projecting from an opening 96 of the different groove 92 toward the other member 70 is preferably within a range of 0.30 to 1.00 mm, more preferably within a range of 0.40 to 0.80 mm, and further preferably within a range of 0.45 to 0.55 mm.

[0104]

With such a projecting amount H3, it is possible to reliably prevent the one member 50 and the other member 70 from directly coming into contact with each other and possible to reliably maintain the sealing performance required for the composite seal material 10 for a long period of time.

[0105]

As described above, the composite seal material 10 of the present invention can be variously modified in a range not deviating from an object of the present invention.

Reference Signs List

[0106]

10 composite seal material

20 first member

22 seal body portion

	24	lip portion
	26	bulge portion
	28	bottom
	40	second member
5	42	base portion
	44	extension piece
	46	bottom
	48	engagement projection
	50	one member
10	52	seal groove
	54	one wall
	56	other wall
	58	bottom wall
	60	opening
15	70	other member
	80	semiconductor manufacturing apparatus
	90	recess
	92	different groove
	94	spacer member
20	96	opening
	100	composite seal material
	102	first member
	104	second member
	150	semiconductor manufacturing apparatus

152 one member

154 seal groove

156 one wall

158 other wall

5 160 other member

T1 maximum width of composite seal material

T2 narrowest width at opening of seal groove

$\theta 1$ inclination angle of lip portion

$\theta 2$ inclination angle of extension piece

10 H1 maximum height of composite seal material in
thickness direction

H2 maximum depth of seal groove

H3 projecting amount of spacer member

CLAIMS

[Claim 1]

A composite seal material having an annular shape and
5 comprising a first member and a second member that are
adjacent to each other on left and right,

wherein the first member includes

a seal body portion, and

a lip portion extending from the seal body portion
10 upwardly in a thickness direction of the composite seal
material, and

wherein the lip portion of the first member extends in
an inclined orientation outwardly on a side opposite to the
second member adjacent thereto.

15 [Claim 2]

The composite seal material according to claim 1,
wherein an inclination angle of the lip portion is within a
range of 30 to 60 degrees.

[Claim 3]

20 The composite seal material according to claim 1 or
claim 2,

wherein the seal body portion of the first member is
provided with

a bulge portion at a side portion on a side opposite to

the second member adjacent thereto.

[Claim 4]

The composite seal material according to any one of
claims 1 to 3,

5 wherein a bottom of the seal body portion is constituted
by
a flat surface.

[Claim 5]

The composite seal material according to any one of
10 claim 1 to 3,

wherein a bottom of the seal body portion is provided
with
a recess.

[Claim 6]

15 The composite seal material according to any one of
claims 1 to 5,

wherein the second member includes
a base portion, and
an extension piece extending from the base portion
20 upwardly in the thickness direction of the composite seal
material, and

wherein the extension piece extends in an inclined
orientation toward the first member adjacent thereto.

[Claim 7]

The composite seal material according to claim 6,
wherein an inclination angle of the extension piece is within
a range of 50 to 80 degrees.

[Claim 8]

5 The composite seal material according to claim 6 or
claim 7,

 wherein a bottom of the base portion is constituted by
 a flat surface.

[Claim 9]

10 The composite seal material according to any one of
claims 6 to 8,

 wherein the base portion is provided with
 an engagement projection that is to be engaged with the
first member.

15 [Claim 10]

 The composite seal material according to any one of
claims 1 to 9,

 wherein the first member is formed of an elastic member,
and

20 wherein the second member is formed of a material harder
than the first member.

[Claim 11]

 The composite seal material according to any one of
claims 1 to 10, wherein the first member and the second

member are bonded to each other by an adhesive.

[Claim 12]

The composite seal material according to any one of claims 1 to 11,

5 wherein the composite seal material is
used to seal a gap between one member and another member,
and, when the composite seal material is mounted in a seal
groove provided in the one member,

10 the first member is located on a side of one wall of the
seal groove, and the second member is located on a side of
another wall.

[Claim 13]

The composite seal material according to claim 12,
wherein a maximum height of the composite seal material in
15 the thickness direction is within a range of 1.10 to 1.70
times with respect to a maximum depth of the seal groove.

[Claim 14]

The composite seal material according to claim 12 or
claim 13, wherein a maximum width from an end of the first
20 member to an end of the second member in a left-right
direction of the composite seal material is within a range of
1.01 to 1.30 times with respect to a narrowest width of the
composite seal material at an opening of the seal groove.

[Claim 15]

The composite seal material according to any one of claims 12 to 14,

wherein the seal groove is

one of a dovetail groove, a single dovetail groove, and
5 a rectangular groove.

[Claim 16]

The composite seal material according to any one of claims 12 to 15, wherein each of the one member and the other member is a semiconductor manufacturing apparatus.

10 [Claim 17]

The composite seal material according to any one of claims 12 to 16, wherein a different groove is further provided on an outer side of the seal groove provided in the one member, and a spacer member having a substantially
15 quadrangular cross-section is disposed in the different groove.

[Claim 18]

The composite seal material according to claim 17,
wherein, when the spacer member is disposed in the
20 different groove,

a projecting amount of the spacer member that projects from an opening of the different groove toward the other member is within a range of 0.30 to 1.00 mm.